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Hazardous Materials Technical Center

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INSTALLATION RESTORATION PROGRAM

PRELIMINARY ASSESSMENT

BIG MOUNTAIN RADIO RELAY STATION, ALASKA

April 1989

Submitted to:

HQ AAC/DEPV
Elmendorf AFB, AK 99506

Submitted by:

Hazardous Materials Technical Center
The Dynamac Building
11140 Rockville Pike
Rockville, MD 20852

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EXECUTIVE SUMMARY

A. Introduction

The Hazardous Materials Technical Center (HMTC) was retained in January 1988 to conduct the Installation Restoration Program (IRP) Preliminary Assessment of Big Mountain Radio Relay Station (RRS), Alaska, under Contract No. DLA-900-82-C-4426 with funds provided by Alaskan Air Command (AAC).

Department of Defense (DoD) policy was directed by Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5 dated 11 December 1981, and implemented by Air Force message dated 21 January 1982, as a positive action to ensure compliance of Air Force installations with existing environmental regulations. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the Installation Restoration Program. DoD policy is to identify and fully evaluate suspected problems associated with past hazardous material disposal sites on DoD facilities, control the migration of hazardous contamination from such facilities, and control hazards to health and welfare that may have resulted from these past operations.

To implement the DoD policy, a four-phased IRP has been directed consisting of:

- Preliminary Assessment (PA) - to identify past spill or disposal sites posing a potential and/or actual hazard to public health or the environment;
- Site Investigation/Remedial Investigation/Feasibility Study (SI/RI/FS) - to acquire data via field studies, for the confirmation and quantification of environmental contamination that may have an adverse impact on public health or the environment and to select a remedial action through preparation of a feasibility study;
- Research, Development and Demonstration (RD & D) - if needed, to develop new technology for accomplishment of remediation; and
- Remedial Design/Remedial Action (RD/RA) - to prepare designs and specifications and to implement site remedial action.

The Big Mountain RRS Preliminary Assessment included:

- an onsite visit, including interviews with six AAC personnel, conducted by HMTC personnel during 13 through 23 June 1988;
- the acquisition and analysis of pertinent information and records on hazardous material use and hazardous waste generation and disposal at the installation; and
- the acquisition and analysis of available geological, hydrological, meteorological, and environmental data from pertinent Federal, State, and local agencies.

B. Major Findings

Past installation operations involved the use and disposal of materials and wastes that were subsequently categorized as hazardous. The major operations of the installation that used and disposed of hazardous materials/hazardous waste (HM/HW) included management of diesel fuel used to power the generators, management of lead-acid and nickel-cadmium batteries used to store electricity, use of asbestos as a construction material, and handling of electrical equipment possibly containing polychlorinated biphenyls (PCBs).

C. Conclusions

Based on information obtained through interviews with Air Force personnel and installation records, small quantities of hazardous materials were used at the RRS while the facility was in operation. It is unknown if the above-ground fuel tanks at the facility were drained and properly abandoned in place. The electrical equipment has not been removed from the site. At the time of the site visit, no evidence of contamination was visible at the RRS. However, as it was a common practice at similar facilities to bury drums and waste liquids, a landfill may exist in the vicinity of the RRS.

D. Recommendations

Although small quantities of HM/HW remain at Big Mountain RRS, they pose no immediate threat to human health and the environment. At the time of the site visit, no visible signs of contamination were evident at the RRS. However, further IRP investigation is recommended for the facility to determine if a landfill is present and if its contents are hazardous. If the waste proves to be hazardous, the landfill should be remediated according to applicable state and Federal regulations. The Air Force should also proceed with the abatement of any asbestos remaining within the buildings and removal of the electrical equipment and all HM/HW from the buildings.

I. INTRODUCTION

A. Background

The United States Air Force, due to its primary mission, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, State, and local governments have developed strict regulations to require that disposers of hazardous materials/hazardous wastes (HM/HW) identify the locations and contents of disposal sites and take action to eliminate the hazards in an environmentally responsible manner. The current Department of Defense (DoD) Installation Restoration Program (IRP) policy was directed by Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5 dated 11 December 1981, and implemented by Air Force message dated 21 January 1982, as a positive action to ensure compliance of military installations with existing environmental regulations. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the IRP. DoD policy is to identify and fully evaluate suspected problems associated with past HM/HW disposal sites on DoD facilities, to control the migration of hazardous contamination, and to control hazards to health and welfare that may have resulted from these past operations. The IRP is a basis for response actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and the Superfund Amendments and Reauthorization Act (SARA) of 1986.

To conduct the IRP Preliminary Assessment for Big Mountain Radio Relay Station (RRS), the Headquarters Alaskan Air Command/Directorate of Programs and Environmental Planning (HQ AAC/DEPV) retained the Hazardous Materials Technical Center (HMTC) (operated by Dynamac Corporation) in January 1988 under Contract No. DLA-900-82-C-4426.

The Preliminary Assessment comprises the first phase of the DoD IRP and is intended to review installation records to identify possible hazardous waste-contaminated sites and to assess the potential for contaminant migration

from the installation. The Site Investigation (not part of this contract) consists of follow-on field work as determined from the Preliminary Assessment. The Site Investigation includes a preliminary monitoring survey to confirm the presence or absence of contaminants. Upon confirmation of contamination, additional field work is implemented under a Remedial Investigation (not part of this contract) to determine the extent and magnitude of the contaminant migration and provide data necessary for determining appropriate remedial actions, which are evaluated during the Feasibility Study (not part of this contract). Research, Development, and Demonstration (not part of this contract) consists of a technology base development study to support the development of project plans for controlling migration or restoring the installation. Remedial Design/ Remedial Action (not part of this contract) includes those activities which are required to control contaminant migration or restore the installation.

B. Authority

The identification of hazardous waste disposal sites at Air Force installations was directed by Defense Environmental Quality Program Policy Memorandum 81-5 (DEQPPM 81-5) dated 11 December 1981, and implemented by Air Force message dated 21 January 1982, as a positive action to ensure compliance of Air Force installations with existing environmental regulations.

C. Purpose of the Preliminary Assessment

DoD policy is to identify and fully evaluate suspected problems associated with past hazardous material disposal sites and spill sites on DoD facilities, control the migration of hazardous contamination from such facilities, and control hazards to health or welfare that may have resulted from these past operations. HMTC evaluated the existence and potential for migration of HM/HW contaminants at Big Mountain RRS by visiting the installation; reviewing existing installation records concerning the use, generation and disposal of HM/HW; reviewing available environmental information; and conducting interviews with present Air Force personnel who are familiar with past hazardous materials management activities at the installation.

A physical inspection was made of the suspected sites. Relevant information collected and analyzed as a part of the Preliminary Assessment included the history of the installation, with special emphasis on the history of past operations and their past HM/HW management procedures; local geological, hydrological, and meteorological conditions that may affect migration of contaminants; local land use,and zoning requirements that could affect the potential for exposure to contaminants; and the ecological settings that indicate environmentally sensitive habitats or evidence of environmental stress.

D. Scope

The Preliminary Assessment program included a pre-performance meeting, an onsite installation visit, a review and analysis of the information obtained, and preparation of this report.

The pre-performance meeting was held at HQ AAC/DEPV, Elmendorf Air Force Base, Alaska, on 13 June 1988. Attendees at this meeting included representatives of HQ AAC/DEPV and HMTC. The purpose of the pre-performance meeting was to provide detailed project instructions, clarification, and technical guidance by AAC, and to define the responsibilities of all parties participating in the Big Mountain RRS Preliminary Assessment.

The scope of this Preliminary Assessment is limited to the installation and includes:

- An onsite visit;
- The acquisition of pertinent information and records on hazardous materials use and hazardous wastes generation and disposal practices at the installation;
- The acquisition of available geological, hydrological, meteorological, land use, and critical habitat data from various Federal, State and local agencies;
- A review and analysis of all information obtained; and
- The preparation of a report to include recommendations for further actions, if warranted.

The onsite visit, records search, and interviews with Air Force personnel were conducted during the period 13 to 23 June 1988. The Preliminary Assessment site visit was conducted by Mr. Lance Gladstone, Geologist; Mr. Ken Clark, Project Manager; Ms. Betsy Briggs, Project Leader; Ms. Natasha Brock, Environmental Scientist; and Mr. Dave Hale, Civil Engineer (Appendix A). Other HMTC personnel who assisted in the Preliminary Assessment included Mr. Mark Johnson, P.G./ Program Manager; Ms. Grace Hill, Environmental Scientist; and Ms. Janet Emry, Hydrogeologist. Personnel from AAC who assisted in the Preliminary Assessment included Mr. James W. Hostman, Chief, Environmental Planning HQ AAC/DEPV and Mr. Jeffrey M. Ayres, Point of Contact (POC) at HQ AAC/DEPV.

E. Methodology

A flow chart of the Preliminary Assessment Methodology is presented in Figure 1. This Preliminary Assessment methodology ensures a comprehensive collection and review of pertinent site specific information, and is used in the identification and assessment of potentially contaminated hazardous waste spill/disposal sites.

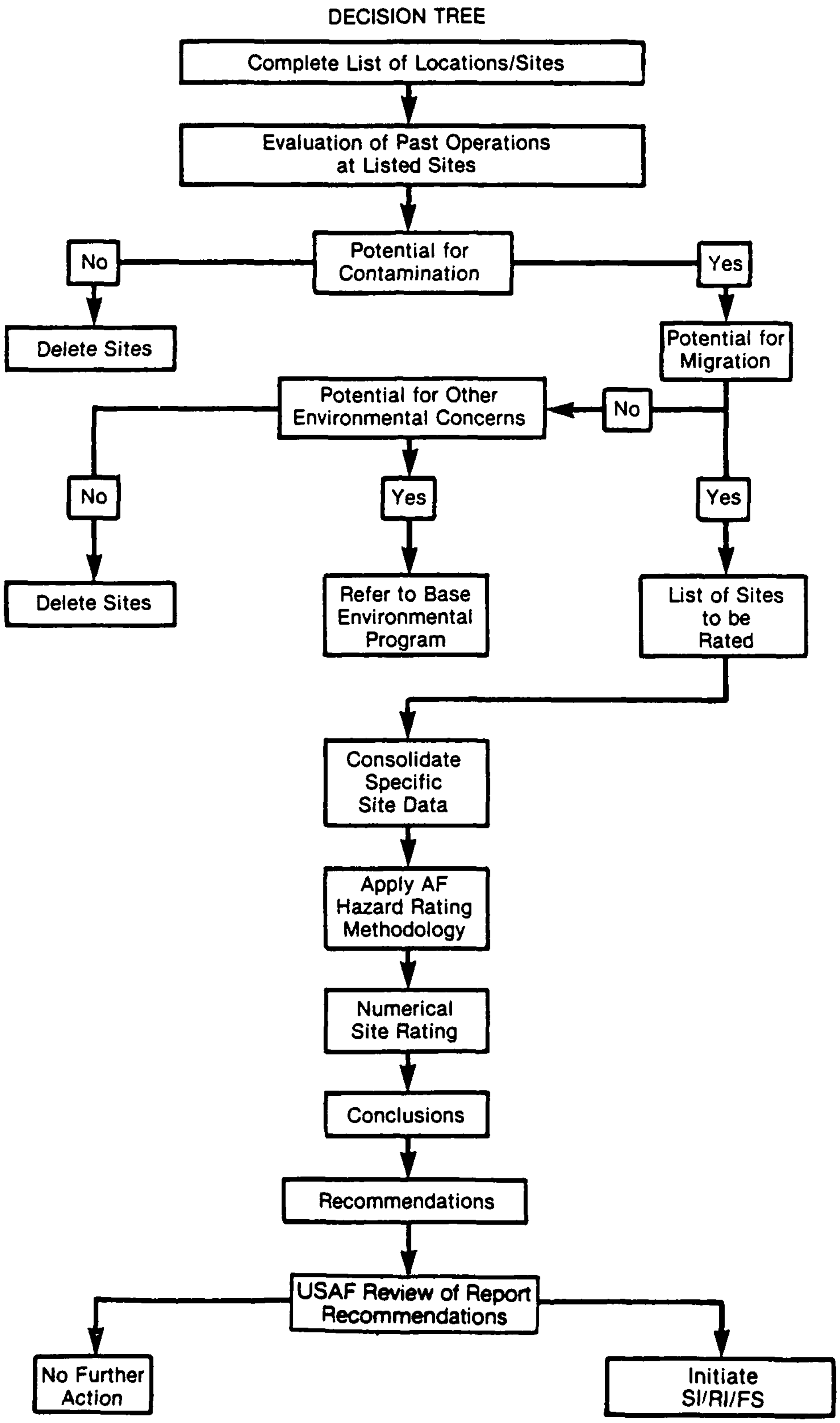
The Preliminary Assessment begins with a site visit to the installation to identify all potential areas where contamination may have resulted from the use or disposal of HM/HW. Next, an evaluation of past HM/HW handling procedures at the identified locations is made to determine whether environmental contamination may have occurred. The evaluation of past HM/HW handling practices is facilitated by extensive interviews with Air Force personnel familiar with the various past operating procedures at the installation. The interviews also define the areas on the installation where any waste materials, either intentionally or inadvertently, may have been used, spilled, stored, disposed of, or released into the environment.

Historical records are collected and reviewed to supplement the information obtained from interviews. Using the information outlined above, a list of past waste spill/disposal sites on the installation is identified for further evaluation. A general survey tour of the identified spill/disposal sites, the

HMTC PRELIMINARY ASSESSMENT INSTALLATION RESTORATION PROGRAM

Figure 1.

Preliminary Assessment Methodology Flow Chart.



installation, and the surrounding area is conducted to determine the presence of visible contamination and to help assess the potential for contaminant migration. Particular attention is given to locating nearby drainage ditches, surface water bodies, residences, and wells where they are present.

Detailed geological, hydrological, meteorological, land use, and environmental data for the area of study is also obtained from the POC and from appropriate Federal, State, and local agencies. A list of outside agencies contacted is in Appendix B. Following a detailed analysis of all the information obtained, sites are identified as suspect areas where HM/HW disposal may have occurred. Evidence at these sites suggests that they may be contaminated and that the potential for contaminant migration exists. Where sufficient information is available, sites are assigned a Hazard Assessment Score (HAS) using the U.S. Air Force HARM (Appendix C). However, the absence of a HAS does not necessarily negate a recommendation for further IRP investigation, but rather may indicate a lack of data.

II. INSTALLATION DESCRIPTION

A. Location

Big Mountain RRS is located at the north end of the Alaskan peninsula on the east shore of Iliamna Lake, in Sections 17, 18, 19, and 30, Township 9 South, Range 35 West, and in Section 25, Township 9 South, Range 36 West, Seward Meridian. Access to the RRS is primarily by airlift to the main runway at the base of the mountain and gravel access road to the communication facility (Figure 2).

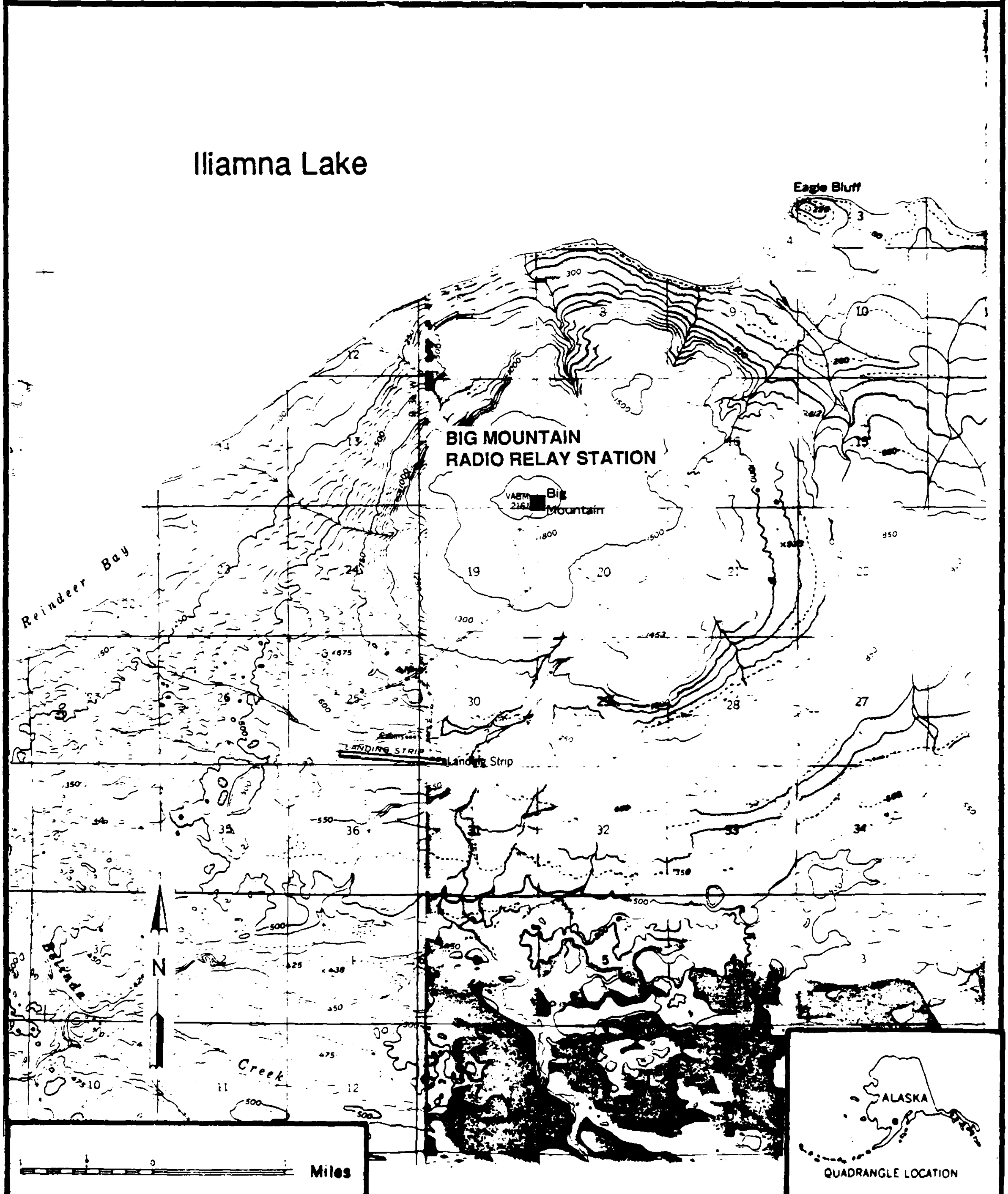
Big Mountain RRS consists of a total of 451 acres, including the runway, access road, communication facility, and an old runway site near Iliamna Lake. There are three fuel tanks (two 1,000-gallon and one 42,400-gallon) at the beginning of the access road to the communication facility (Figure 3). The communication facility consists of an equipment building, dormitory, and temporary warehouse that are connected by a covered walkway; two above-ground fuel storage tanks; a temporary auto storage building, and four antennas (see Figure 4). The surrounding terrain at the base of Big Mountain is covered by light to moderate brush, with occasional stands of spruce or deciduous trees; Big Mountain, which is mostly above the treeline, is barren ground or covered by tundra with scattered clumps of brush. The RRS is located in a completely remote area.

B. History

The Big Mountain RRS was in operation as a tropospheric scatter station from September of 1957 to April of 1979. It was one of 31 White Alice installations constructed by the U.S. Army Corps of Engineers and Western Electric Company to provide an economical communications system for Alaska. Once completed, the White Alice relay stations successfully linked Aircraft Control & Warning (AC&W) and Distant Early Warning (DEW-line) sites into a cohesive network, and relayed communications back to Elmendorf AFB and Eielson AFB. All the tropospheric scatter stations, like the one at Big Mountain, were situated in remote areas (Reynolds, 1988).

Source: U.S.G.S.
Iliamna (B-6 and B-7)
Quadrangle, Alaska, 7.5
Minute Series Topographic Map, 1966 and 1968.

Figure 2.
Location Map of Big Mountain Radio Relay Station, Alaska.



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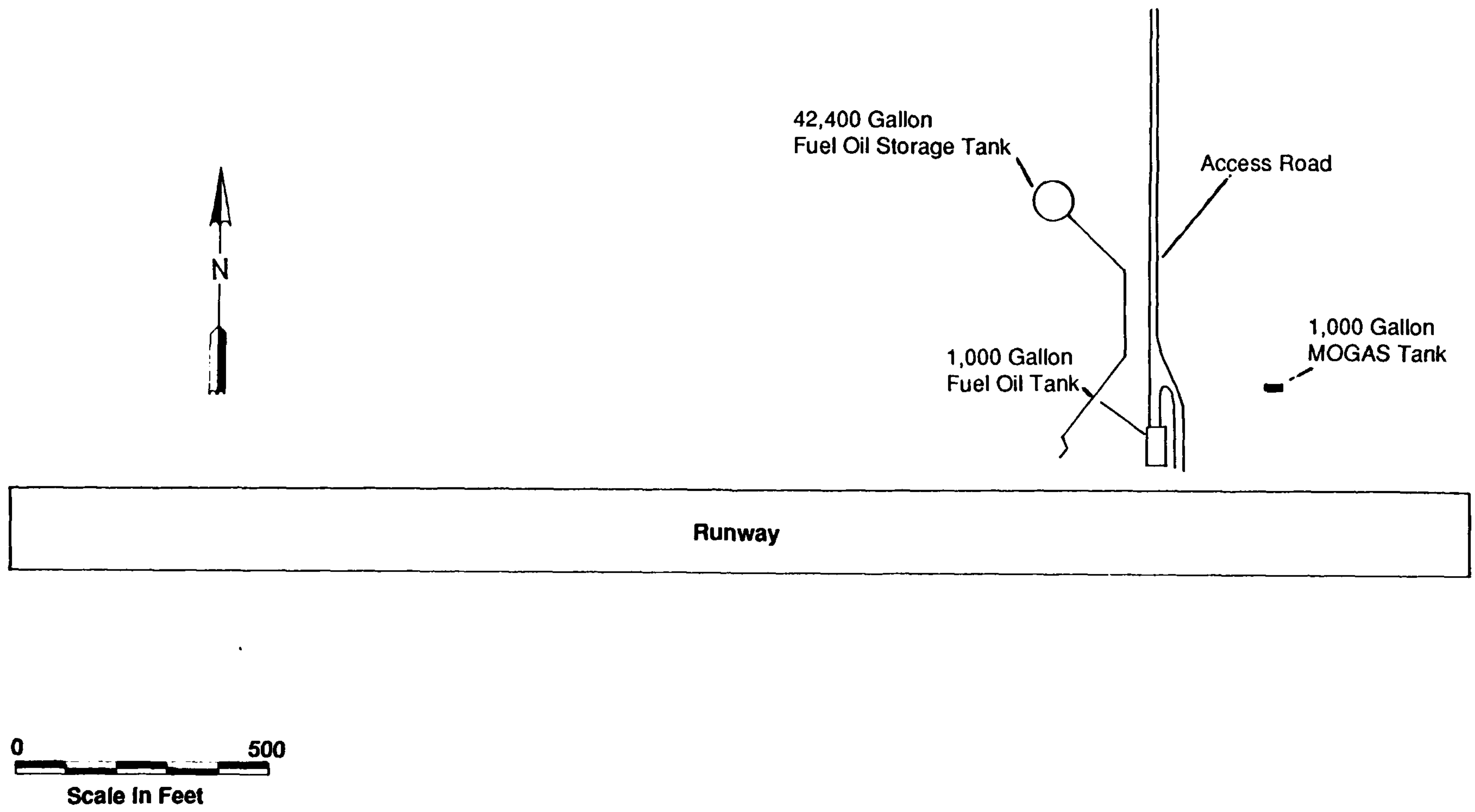
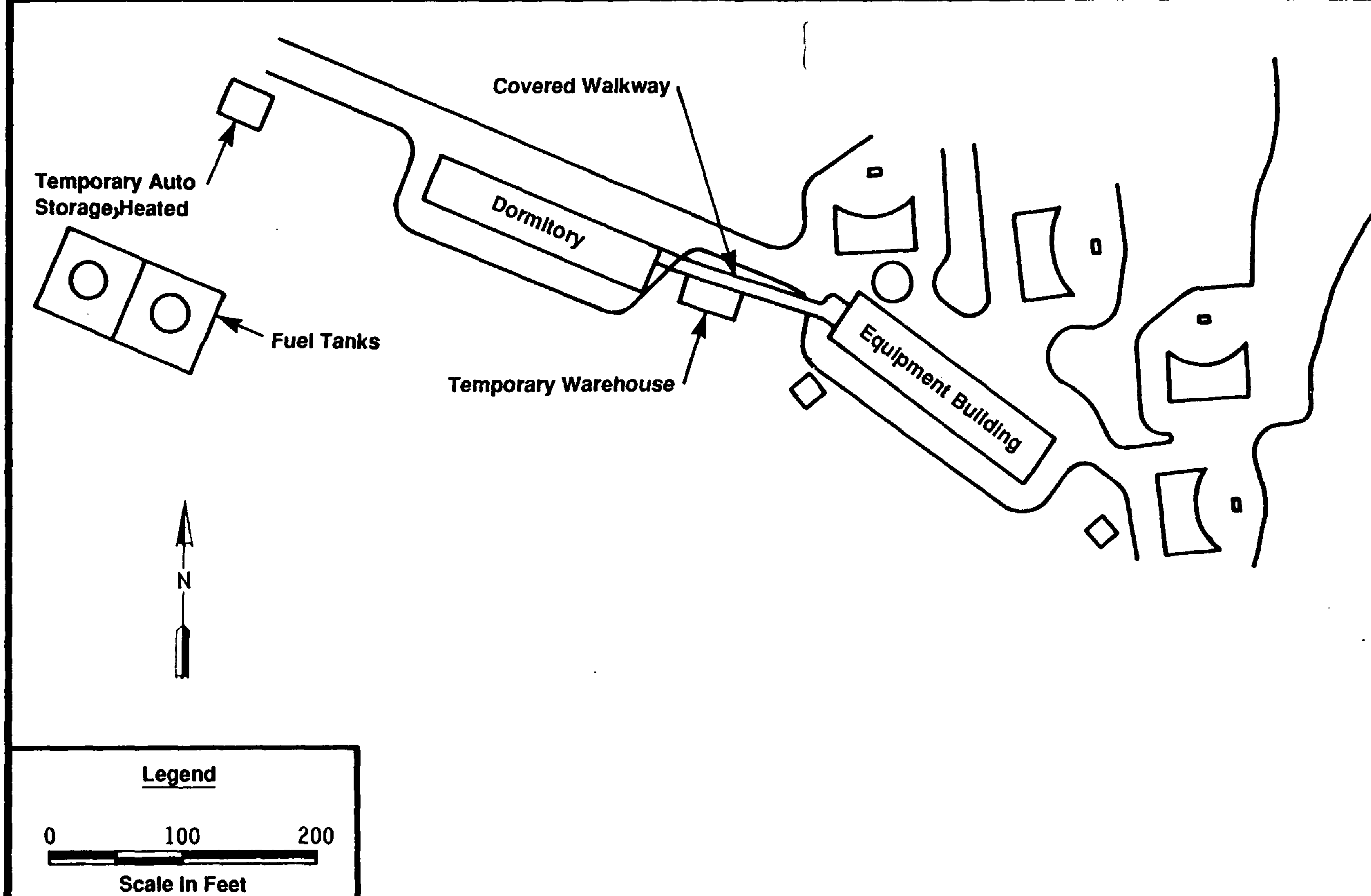
Source: Department of the Air Force, Big Mountain Air Strip, Drawing No. AMC-399-14-1-53, 1960.

Figure 3.
Site Map of Runway at Big Mountain Radio Relay Station, Alaska.



Source: U.S.A.F. Big Mountain
Radio Relay Site,
66 MCP Site Plan, Undated.

Figure 4.
Site Map of Big Mountain Radio Relay Station, Alaska.



In the 1960s, Alaska Telephone Switching Station (ATSS-4A) capabilities were added to Big Mountain RRS, Kalakaket Creek RRS, Pedro Dome RRS, and Neklasson Lake RRS. These four installations varied in layout and function and were hubs for the entire network. Because the circuitry at these facilities was diversified, if one facility malfunctioned, the other three could still communicate. The facilities at Big Mountain RRS included an equipment and power building measuring 7,200 square feet, and a 16-person dormitory measuring 5,200 square feet. At the base of the mountain, adjacent to the runway, was a automotive maintenance shop to service vehicular equipment.

The advent of communication satellites in the late 1950s and early 1960s soon rendered the WACS obsolete. The Soviet launch of Sputnik on 4 October 1957 was the first step toward a revolutionary change in communication technology with which the WACS could not compete. In 1967, Congress passed Public Law 90-135, "Alaska Communications Disposal Act," for the purpose of transferring U.S. government owned long-distance communications facilities in Alaska to private entities. The following year, the WACS, including the Big Mountain site, was taken over by RCA Alaska Communications (now ALASCOM).

III. ENVIRONMENTAL SETTING

A. Meteorology

Big Mountain RRS and the Iliamna Lake region have a continental climate typical of the Interior Basin of Alaska. This climate is characterized by extreme seasonal variations in temperature and by low total precipitation. The inland temperature is correspondingly warmer in summer and colder in winter than along the Pacific coast to the east, where the almost constant cloud cover exerts a modifying influence (Detterman and Reed, 1973).

The mean annual precipitation is about 28 inches, and the mean annual temperature is approximately 35°F. Maximum rainfall intensity, based on 10-year, 24-hour rainfall, is 2.3 inches (Miller, 1963). The net precipitation is calculated by subtracting mean annual lake evaporation from mean annual precipitation (47 FR 31227). Since mean annual lake evaporation rates are not available for this part of Alaska, annual potential evapotranspiration rate is used (NOAA, personal communication, 1988). The annual potential evapotranspiration rate for Iliamna is 17.80 inches per year (Patric and Black, 1968), therefore, the net precipitation is 10.20 inches per year.

B. Geology and Soils

Most of the bedrock in the western part of the Iliamna quadrangle and along the west flank of the Alaska and Aleutian Ranges is composed of volcanic and volcaniclastic rock of Tertiary age. Glacial debris mantles much of the area west of the mountains; however, nearly all of the hills consist of volcanic rock, which also probably underlies the surficial materials. These rocks represent an episode that began in early Tertiary time and is still continuing on Augustine Island and at Iliamna Volcano.

The volcanic rock exposed is highly varied in composition. Most rocks are in the intermediate class of andesite to basaltic andesite, but they range from sodic rhyolite to olivine basalt. Because age determinations were not made on

these volcanic rocks, their division on the geologic map (Figure 5) is based chiefly on lithology. The general informal units used are basalt and andesite, tuff, and volcanic rubble (Detterman and Reed, 1980).

Tertiary flows in the Iliamna quadrangle range from dark gray, green, and black to light tan and red. Most are porphyritic, but they range from highly vesicular to aphanitic and glassy. Rocks of dark color and porphyritic texture predominate; most can be classified as andesite or basaltic andesite. Basalt, dacite, and rhyolite are common locally. Columnar jointing is generally well developed in the basaltic and andesitic flows. The thickness of these units is highly variable, but thought not to exceed 1,000 meters (Detterman and Reed, 1980).

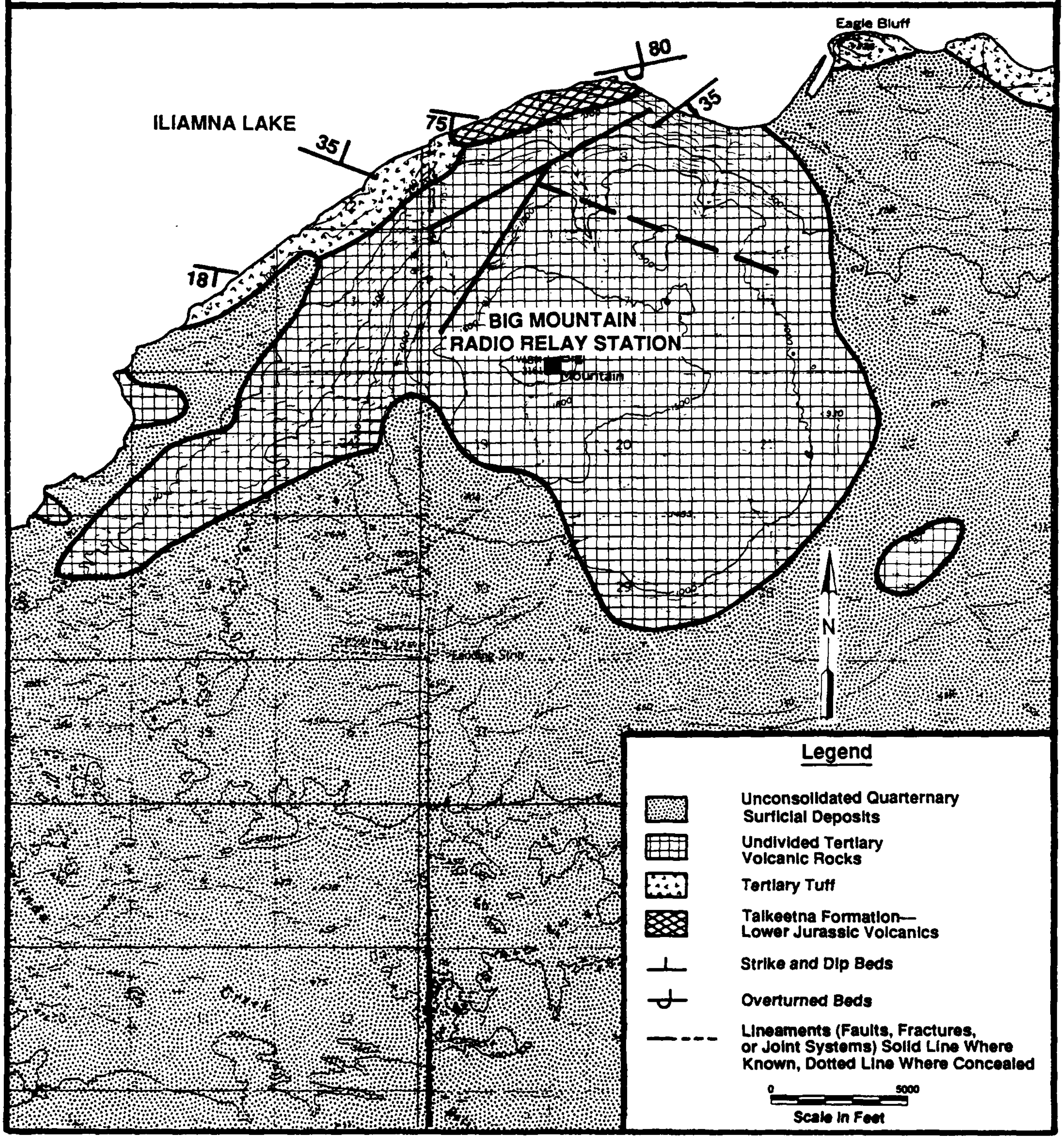
Bedded tuff is a major component of the Tertiary volcanic sequence in the quadrangle. The Big Mountain area was a major source of tuff in the region. Moderately to steeply dipping beds in the cliffs at the base of Big Mountain indicate a minimum thickness of at least 2,000 meters of welded crystal and lithic tuff. These rock types are light-gray to tan and contain shattered phenocrysts of plagioclase and quartz, pumice and lithic fragments, and zeolite minerals (Detterman and Reed, 1980).

Volcanic rubble and breccia flows, some of which probably originated as lahars, are found throughout the quadrangle interbedded with the other volcanic rocks. Rubble and breccia are not as abundant as tuffs or lava flows.

Soil formation and development largely dates from the close of the Wisconsin Glaciation, when glaciers covered most of the Iliamna area. Most of the deposits were formed by four major Pleistocene advances, a period of glacial activity known as the Brooks Lake glaciation. The individual stades are, from oldest to youngest, Kvichak, Iliamna, Newhalen, and Iliuk. In the Big Mountain area, only the Kvichak and Iliamna stades have been mapped. These deposits mantle the base of Big Mountain on its south and southwest flanks, respectively. Other unconsolidated surficial deposits in the area include glacial drift to the south and east, lake terrace and beach ridge deposits to the west, and flood plain

Source: U.S.G.S.
Bulletin 1368-B,
Plate 1, 1980.

Figure 5.
Geological Map of Big Mountain Radio Relay Station, Alaska And Vicinity.



alluvium along the streambeds (Detterman and Reed, 1973). Figure 6 delineates the occurrence of these surficial deposits within the vicinity of Big Mountain RRS.

Moraines of the Brooks Lake Glaciation are little modified, and have retained their fresh knob-and-kettle topography. The Kvichak and Iliamna stades contain a heterogeneous assemblage of rock types, indicating the multiple source areas of the tributary glaciers. They are represented, for the most part, by one prominent end moraine with associated ground moraine and glaciofluvial deposits, recessional moraines, and push moraines.

Glacial drift in the form of outwash plains and till cover many square miles of the Iliamna region. The largest plains border the fronts of the Kvichak and Iliamna end moraines, where they are commonly one to two miles wide and many miles long. Typically, they are composed of alternating layers of silt and gravel with lenses of cobbles.

Lake terrace and beach ridge deposits on the west flank of Big Mountain are commonly found along much of Iliamna Lake. The multiple terraces are generally 1,000 to 3,000 feet wide, slope lakeward at about 5°, and are terminated by wave-cut scarps behind another terrace at a lower level. Profiles of these deposits typically contain fine sand and silt at the top, grading to unsorted, weathered till with depth.

Holocene alluvium deposits are formed by the action of running water of streams and creeks draining toward Iliamna Lake. Interstratified sand and gravel make up the bulk of the alluvial materials throughout the quadrangle. Silt and fine sand are also major constituents in the alluvium near Big Mountain. The silt is poorly to well stratified; it is mainly brown but includes some gray and black material. The black silt contains variable amounts of organic material, and the gray silt is probably a glacial lake deposit. These valley-fill sediments are poorly drained, nearly flat, and coextensive with abundant swamps and muskeg (Detterman and Reed, 1973).

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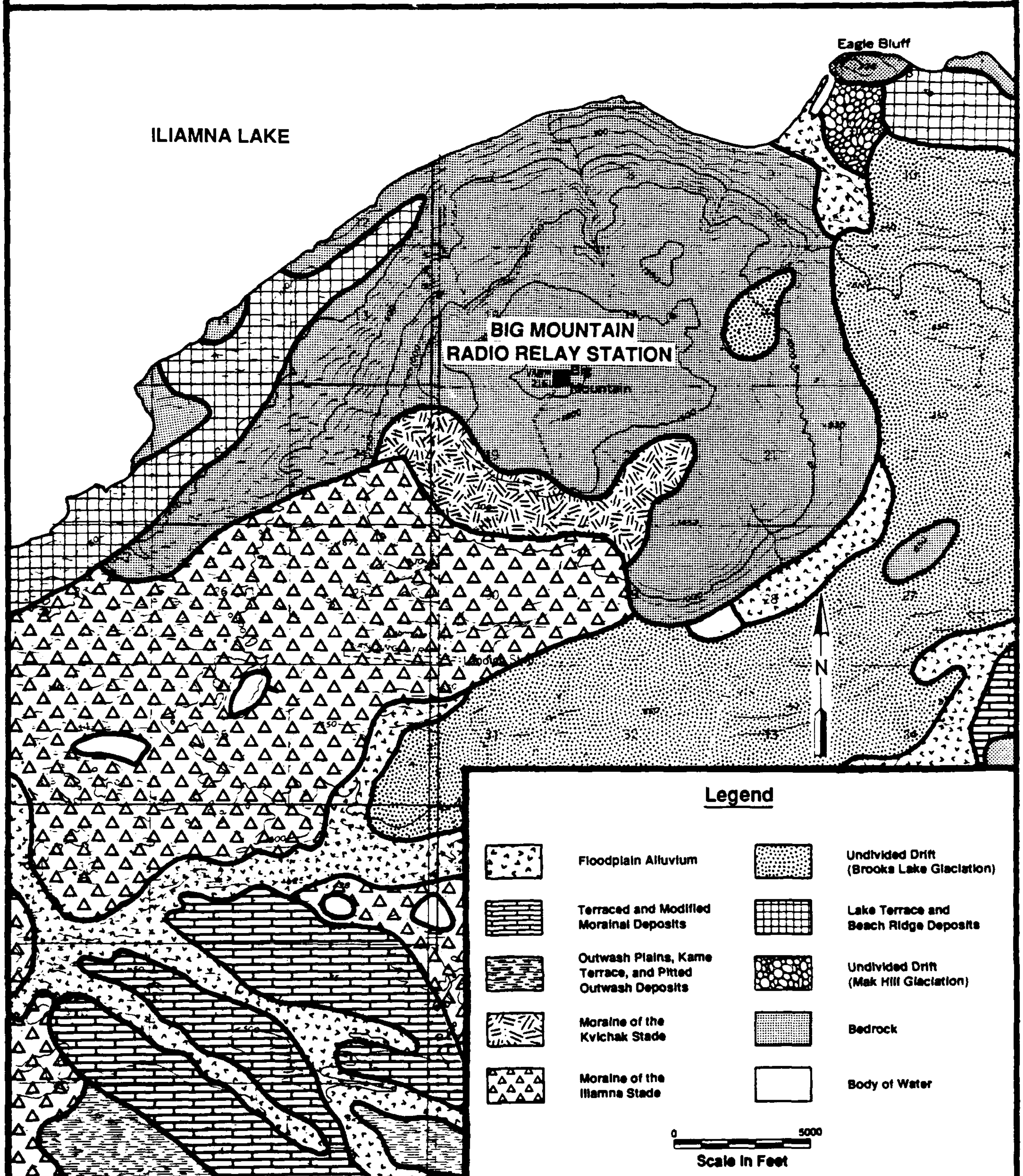
Source: U.S.G.S. Bulletin 1368-B, Plate 1, 1980.

Figure 6.
Surficial Deposits Map of Big Mountain Radio Relay Station, Alaska and Vicinity.



According to the U.S. Soil Conservation Service, the soils at Big Mountain RRS belong to the Typic Cryandepts, very gravelly, hilly to steep-rough mountainous land association. This association occupies steep mountainous areas in the eastern part of the Alaska Peninsula. Elevation in this area ranges from nearly sea level on the coast to about 5,500 feet on the highest peak. The vegetation along the rivers is dominantly willow, alder, and grasses. On valley walls and in areas protected from strong winds below 1,000 feet elevation, alder, grasses, and associated shrubs and forbs are dominant. Areas above 1,000 feet and areas exposed to strong winds support low shrubs, forbs, and lichens. Mountain peaks and ridges, rock escarpments, and talus slopes have a sparse shrubby tundra vegetation or are barren.

Typic Cryandepts, very gravelly, hilly to steep, make up 55 percent of this association; they are shallow, well drained volcanic ash over very gravelly glacial till on valley sides and rounded hills. Typically, under a mat of litter and roots, the soils consist of 10 to 20 inches of dark brown loamy volcanic ash over dark brown very gravelly loam. The soils are strongly acid.

Rough mountainous land comprises 35 percent of this association and consists of mountain peaks and ridges, rock escarpments, and talus slopes with little or no soil cover. These areas are generally above 2,000 feet and either barren or sparsely vegetated with shrubby tundra plants.

The remainder of this association (10 percent) is composed of riverwash, recent deposits of sand and gravel on flood plains of braided rivers. These areas are mostly barren.

C. Hydrology

Surface Water

Iliamna Lake is the dominant body of surface water in the area; it is 80 miles long and averages about 12 miles wide. Iliamna Lake is located approximately 10,000 feet to the north of Big Mountain. Due to its elevation,

Big Mountain RRS is not located with the 100-year flood plain of Iliamna Lake. Iliamna Lake is a moraine-dammed lake in a preexisting depression that was originally an extension of Bristol Bay. The second largest natural fresh-water lake entirely within the confines of the United States, it has 1,033 square miles of surface area, 260 miles of shoreline, and is as much as 1,192 feet deep. Also, there are many smaller lakes and glacial ponds from a few hundreds of feet to several miles in length within the Big Mountain area. These kettle ponds are undrained; a few are being filled with loess and vegetation, but most still retain the irregular shape left by the melting ice blocks. Drainage is poorly integrated, and the streams are nearly all controlled by morainal borders. Much of the area between ponds is covered by quaking bogs, in which the water level is at or near the surface. The only firm ground is adjacent to streams that cross the deposits (Detterman and Reed, 1973).

Most of the streams entering Iliamna Lake are deeply entrenched and are lowering their channels in response to progressive lowering of the lake level. Iliamna River is one exception; it is situated at grade and periodically floods the width of the valley it traverses. This occurs because the lower 5 to 6 miles of its course is across an old lake bed formed by a higher stand of water in Iliamna Lake and the stream is graded to a level only slightly above that of the present lake. Normally the level of Iliamna Lake rises about 5 feet during the heavy rainfall season from June through August; this change in level brings the Iliamna River about to grade, and there is little movement of alluvium along its lower courses.

Groundwater

Specific groundwater data for the Big Mountain RRS area are not available; however, some general assumptions can be made based on the nature of the soils and geology of the region. Groundwater in the vicinity of the communication facility most likely occurs within joints and fractures of the underlying volcanic rocks; within the matrix of the more permeable volcanic deposits including pumice, breccia flows, tuffs, and volcanic ash beds; and along the bedding planes of these deposits. Joints generally occur in the uppermost 300

feet, while fractures associated with faulting can occur at any depth (Fetter, 1980). The depth at which groundwater would be encountered in this area is unpredictable without site specific data, given the heterogeneous nature of the subsurface materials and their associated structural characteristics.

As the communication facility is situated on a topographically high area, groundwater would generally flow from this high in all directions toward lower elevations; however, the unpredictable nature and structure of the underlying materials may have a more dominant influence on site-specific flow direction.

Shallow groundwater in the vicinity of the landing strip may occur at depths of less than 30 feet within permeable materials of the unconsolidated morainal deposits. The general groundwater flow direction in this area may range from west to southwest and eventually discharges into Iliamna Lake.

Due to the remote location of the RRS, no water wells are believed to exist in this area.

D. Critical Habitats/Endangered or Threatened Species

According to the U.S. Fish and Wildlife Service, Alaska Division, there are no survey data available for Big Mountain RRS, but there is a low probability of endangered or threatened species within a 1-mile radius of the facility. The potential for active American peregrine falcon eyries, however, increases markedly within 15 miles of the RRS. The American peregrine falcon is a federally-listed endangered species.

No federally- or state-designated critical habitats or wilderness areas are located within a 1-mile radius of Big Mountain RRS. Although the Big Mountain area has not been mapped by the National Wetland Inventory, the U.S. Fish and Wildlife Service believes that wetlands probably exist within the vicinity of the RRS.

IV. FINDINGS

A. Activity Review

A review of AAC records and interviews with Air Force personnel resulted in the identification of specific operations at Big Mountain RRS in which the majority of HM/HW were handled or generated. These operations include:

- Vehicle maintenance, including management of motor gasoline, oils, and antifreeze;
- Management of diesel fuel used to power the generators;
- Management of electrical equipment possibly containing PCBs;
- Management of lead-acid and nickel-cadmium batteries used to store electricity; and
- Usage of asbestos as a construction material.

B. Disposal/Spill Site Identification, Evaluation, and Hazardous Assessment

Interviews with Air Force personnel and subsequent site inspections resulted in the identification of no potentially contaminated sites at Big Mountain RRS. Although no sites were identified or assigned a HAS according to HARM, the methodology and guidelines are included as Appendix C. The objective of this assessment is to identify and provide relative ranking of sites suspected of contamination from hazardous substances. The final rating score would reflect specific components of the hazard posed by a specific site: possible receptors of the contamination (e.g., population within a specified distance of the site and/or critical environments within a 1-mile radius of the site); the waste and its characteristics; and the potential pathways for contaminant migration (e.g., surface water, groundwater, flooding).

C. Other Pertinent Information

At the time of the site visit to Big Mountain RRS on 16 June 1988, the following observations were made:

- The soil around the facility appeared clean and free from contamination (see Photo 1, Appendix D);
- There were areas where the mechanical lines and equipment were covered with asbestos insulating material;
- Several lead-acid storage batteries were observed on the battery racks (see Photos 2 and 3, Appendix D); all of them had been frozen and ruptured;
- The building floors were covered with water mixed with asbestos tiling in various stages of decomposition due to reaction from spilled chemicals, possibly paint thinner (see Photos 4 and 5, Appendix D);
- There were large quantities of lead contained in these buildings in a relatively innocuous state from the batteries and the soldered ends of communication wires;
- The outside of the buildings were, in many cases, covered with asbestos shingles, and the floors of various enclosed antennas were covered with transite corrugated material. The reflection surfaces of the antennas are cadmium clad (see Photo 6, Appendix D);
- Four large diesel fuel powered generators remained in the radio relay building. The generators were rusted and had leaked oil around their bases. However, the leaks were confined to the concrete floor. Between the generators were several partially full 55-gallon drums (see Photos 7, 8, and 9, Appendix D);
- Large quantities of copper or brass pipes and old radar-type tubes were found in the old flight operations building at the base of the mountain (see Photo 10, Appendix D); and
- Approximately 100 yards northeast of the flight operations building was a mound of earth about four feet above the surrounding landscape with some scattered trash (see Photo 11, Appendix D). This area may be a landfill site or a burial site for construction debris. No organic vapors were detected with the a photoionization detector (PID) and no hazardous wastes were reported to have been disposed of in this area.

V. CONCLUSIONS

Based on information obtained through interviews with Air Force Personnel and review of installation records, small quantities of hazardous materials were handled at Big Mountain RRS while the facility was operational. Diesel fuel, batteries, and electrical equipment containing PCBs were used to run the communications facility.

PCB-contaminated items, such as electrical equipment, still remain in the buildings, as do batteries and asbestos. At the time of the site visit, there was no visible evidence of contamination (i.e., stained soil or abandoned drums) at the RRS. However, because it was common practice at similar facilities to bury drums and waste liquids, a landfill may exist at the RRS.

VI. RECOMMENDATIONS

Although small quantities of HM/HW remain at the Big Mountain RRS, these wastes and materials cause no immediate threat to human health and the environment. At the time of the site visit, no visible signs of contamination were evident at the facility; however, it is possibile that a landfill exists at the RRS since it was a common practice at similar facilities to bury drums and waste liquids. As a result, further IRP investigation is recommended to locate the landfill, determine if its contents are hazardous, remove any hazardous materials and contaminated soil, and dispose of the waste according to applicable State and Federal regulations.

In addition, the electrical equipment and all HM/HW should be removed from the buildings, including the abatement of any asbestos remaining within the buildings.

GLOSSARY OF TERMS

ALDER - Any of various shrubs or small trees of the birch family.

ALLUVIAL - Pertaining to or composed of alluvium, or deposited by a stream or running water; e.g., an "alluvial clay" or an "alluvial divide."

ALLUVIAL DEPOSITS - A general term for clay, silt, sand, gravel, or similar unconsolidated material deposited during comparatively recent geologic time by a stream or running water.

ALLUVIAL PLAIN - A level or gently sloping tract or a slightly undulating land surface produced by extensive deposition of alluvium, usually adjacent to a river that periodically overflows its banks.

ALLUVIUM - A general term for clay, silt, sand, gravel, or similar unconsolidated material deposited during comparatively recent geologic time by a stream or running water.

ANDESITE - A dark-colored, fine-grained extrusive (volcanic) rock composed primarily of the minerals feldspar, biotite, hornblende, and pyroxene.

ANDESITIC - Pertaining to, composed of, containing, or resembling andesite.

ANNUAL PRECIPITATION - The total amount of rainfall and snowfall for the year.

APHANITIC - Said of the texture of an igneous rock in which the crystalline component are not distinguishable by the unaided eye.

AQUIFER - A geologic formation, or group of formations, that contains sufficient saturated permeable material to conduct groundwater and to yield economically significant quantities of groundwater to wells and springs.

ASBESTOS - A group of silicate minerals that readily form into thin, strong fibers that are flexible, heat resistant, and chemically inert; used commercially in construction.

BASALT - A general term for a dark-colored mafic igneous rock, commonly extrusive but locally intrusive.

BASALTIC - Pertaining to, composed of, containing, or resembling basalt.

BAY - A wide, curving open indentation, recess, or inlet of a sea or lake into the land or between two capes or headlands, larger than a cove, and usually smaller than, but of the same general character as a gulf.

BEACH - A term commonly used for a sea-shore or lake-shore area, usually covered by sandy or pebbly material.

BED - The smallest formal unit in the hierarchy of lithostratigraphic units. In a stratified sequence of rocks it is distinguishable from layers above and below. A bed commonly ranges in thickness from a centimeter to a few meters.

BEDDING - The arrangement of sedimentary rock in beds or layers of varying thickness and character.

BEDDING PLANE - A planar or nearly planar bedding surface that visibly separates each successive layer of stratified rock from the preceding or following layer.

BEDROCK - A general term for the rock, usually solid, that underlies soil or other unconsolidated, superficial material.

BOG - Waterlogged, spongy ground, consisting primarily of mosses, containing acidic, decaying vegetation that may develop into peat.

BRECCIA - A coarse-grained clastic rock, composed of angular broken rock fragments held together by a mineral cement or in a fine-grained matrix.

BRUSH - A growth of small trees and shrubs.

CHANNEL - The bed where a natural body of surface water flows or may flow.

CLIFF - Any high, very steep to perpendicular or overhanging face of rock; a precipice. A cliff is usually produced by erosion, less commonly by faulting.

COBBLE - A rock fragment larger than a pebble and smaller than a boulder, having a diameter in the range of 64 to 256 mm.

COLUMNAR JOINTING - Parallel, prismatic columns, polygonal in cross-section, in basaltic flows formed as a result of contraction during cooling.

CONTAMINANT - As defined by Section 101(f)(33) of Superfund Amendments and Reauthorization Act of 1986 (SARA) shall include, but not be limited to any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction), or physical deformation in such organisms or their offspring; except that the term "contaminant" shall not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance under:

(a) any substance designated pursuant to Section 311(b)(2)(A) of the Federal Water Pollution Control Act,

(b) any element, compound, mixture, solution, or substance designated pursuant to Section 102 of this Act,

(c) any hazardous waste having the characteristics identified under or listed pursuant to Section 3001 of the Solid Waste Disposal Act (but not including any waste the regulation of which under the Solid Waste Disposal Act has been suspended by Act of Congress),

(d) any toxic pollutant listed under Section 307(a) of the Federal Water Pollution Control Act,

(e) any hazardous air pollutant listed under Section 112 of the Clean Air Act, and

(f) any imminently hazardous chemical substance or mixture with respect to which the administrator has taken action pursuant to Section 7 of the Toxic Substance Control Act;

and shall not include natural gas, liquefied natural gas, or synthetic gas of pipeline quality (or mixtures of natural gas and such synthetic gas).

CONTINENTAL CLIMATE - The climate of the interior of a continent, characterized seasonal temperature extremes and by the occurrence of maximum and minimum temperature soon after summer and winter solstice, respectively.

CREEK - A term generally applied to any natural stream of water, normally larger than a brook but smaller than a river.

CRITICAL HABITAT [Fed] - The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of the Endangered Species Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management consideration or protection; and specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of the Endangered Species Act, upon a determination by the Secretary that such areas are essential for the conservation of the species.

CRITICAL HABITAT [Alaska] - Places where protective emphasis is on the environment in which wildlife occurs. Critical habitats may be complete biotic systems -- identifiable environmental units that operate as self-sustaining systems -- or well-defined areas specifically needed by wildlife for certain functions such as nesting or spawning.

CRYSTAL - A homogeneous, solid body of a chemical element, compound or isomorphous mixture, having a regularly repeating atomic arrangement that may be outwardly expressed by plane faces.

CRYSTALLINE - Said of a rock consisting wholly of crystals or fragments of crystals.

DACITE - A fine-grained extrusive rock with the same general composition as andesite, but having a less calcic plagioclase and more quartz.

DEBRIS - Any surface accumulation of loose material detached from rock masses by chemical and mechanical means.

DECIDUOUS - Shedding foliage at the end of the growing season.

DEPOSITS - Earth material of any type, either consolidated or unconsolidated, that has accumulated by some natural process or agent.

DIPPING BED - A bed of rock that makes an angle with the horizontal; measured perpendicular to the strike of the structure.

DRAINAGE CLASS [natural] - Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained - Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained - Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained - Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained - Water is removed from the soil somewhat slowly during some periods. moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained - Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained - Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough periods during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained - Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet,

where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

ELEVATION - The vertical distance from a datum (usually mean sea level) to a point or object on the Earth's surface; esp. the height of a ground point above sea level.

ENDANGERED SPECIES - Any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of the Endangered Species Act would present an overwhelming and overriding risk to man.

END MORAINE - A ridgelike accumulation that is being produced at the margin of an actively flowing glacier at any given time.

FAULT - A fracture or zone of fractures along which there has been displacement of the sides relative to one another.

FINE-GRAINED - Said of a soil or sediments in which silt and/or clay predominate.

FLOOD PLAIN - The surface or strip of relatively smooth land adjacent to a river channel, constructed by the present river in its existing regimen and covered with water when the river overflows its banks.

FORB - Any herbaceous plant, not a grass or a sedge.

FORMATION - A lithologically distinctive, mappable body of rock.

FRACTURE - A general term for any break in a rock, whether or not it causes displacement, due to mechanical failure by stress. Fracture includes cracks, joints and faults.

FRAGMENT - A piece of rock that has been detached or broken from a pre-existing mass.

FRIABLE - (a) Said of a soil consistency in which moist soil material crushes easily under gentle to moderate pressure and coheres when pressed together; (b) Said of a rock or mineral that crumbles naturally or is easily broken, pulverized or reduced to a powder.

GLACIAL - (a) Of or relating to the presence and activities of ice or glaciers, (b) Pertaining to distinctive features and materials produced or derived from glaciers and ice sheets.

GLACIOFLUVIAL - Pertaining to the meltwater streams flowing from wasting glacier ice and especially to the deposits and landforms produced by such streams; relating to the combined action of glaciers and streams.

GLASSY - Said of the texture of certain extrusive igneous rocks, which is similar to broken glass; developed as a result of rapid cooling of the lava, without distinct crystallization.

GRAVEL - An unconsolidated, natural accumulation of rounded rock fragments resulting from erosion, consisting predominantly of particles larger than sand, such as boulders, cobbles, pebbles, granules or any combination of these fragments.

GROUND MORAINE - An accumulation of till after it has been deposited or released from the ice during ablation, to form an extensive area of low relief devoid of transverse linear elements.

GROUNDWATER - Refers to the subsurface water that occurs beneath the water table in soils and geologic formations that are fully saturated.

HARM - Hazard Assessment Rating Methodology - A system adopted and used by the United States Air Force to develop and maintain a priority listing of potentially contaminated sites on installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts. (Reference: DEQPPM 81-5, 11 December 1981.)

HAS - Hazard Assessment Score - The score developed by using the Hazardous Assessment Rating Methodology (HARM).

HAZARDOUS MATERIAL - Any substance or mixture of substances having properties capable of producing adverse effects on the health and safety of the human being. Specific regulatory definitions also found in OSHA and DOT rules.

HAZARDOUS WASTE - A solid or liquid waste that, because of its quantity, concentration, or physical, chemical, or infectious characteristics may:

a. cause, or significantly contribute to, an increase in mortality or an increase in serious or incapacitating reversible illness, or

b. pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

HETEROGENEOUS - Consisting of parts or elements that are dissimilar or unrelated.

HILL - A natural elevation of the land surface, rising rather prominently above the surrounding land, usually of limited extent and having a well defined outline (rounded) and generally considered to be less than 1,000 feet from base to summit.

HOLOCENE - See RECENT.

ICE SHEET - A glacier of considerable thickness and more than 50,000 sq. km. in area, forming a continuous cover of ice and show over a land surface, spreading outward in all directions and not confined by the underlying topography; a continental glacier.

ILLINOIAN - Pertaining to the classical third glacial stage of the Pleistocene Epoch in North America.

JOINT - A surface of fracture or parting in a rock, without displacement.

KETTLE POND - A body of water occupying a kettle, a steep-sided, usually bowl-shaped hole in glacial drift deposits formed by the melting of a large block of glacial ice.

KNOB-AND-KETTLE TOPOGRAPHY - An undulating landscape in which a disordered assemblage of knolls, mounds, or ridges of glacial drift is interspersed with irregular depressions, pits, or kettles that are commonly undrained and may contain swamps or ponds.

LAHAR - A mudflow composed chiefly of volcaniclastic materials on the flanks of a volcano.

LAKE - Any inland body of standing water occupying a depression in the Earth's surface, generally of appreciable size (larger than a pond) and too deep to allow land plants to take root across the expanse of water.

LAKE BED - The flat to gently undulating ground underlain by fine-grained sediments deposited in a former lake.

LITHIC TUFF - An indurated deposit of volcanic ash in which the fragments are composed of previously formed rocks.

LITHOLOGY - The physical character of a rock.

LOAM - A rich, permeable soil composed of a friable mixture of relatively equal proportions of sand, silt, and clay particles, and usually containing organic matter.

LOESS - A widespread, homogeneous, commonly nonstratified, porous, friable, slightly coherent, usually highly calcareous, fine-grained blanket deposit (generally less than 30 inches thick).

MATRIX - The finer-grained material enclosing, or filling the interstices between, the larger grains or particles of a sediment or sedimentary rock.

MINERAL - A naturally occurring inorganic element or compound having an orderly internal structure and characteristic chemical composition, crystal from and physical properties.

MORAINE - A mound, ridge, or other distinct accumulation of unsorted, unstratified glacial drift, predominantly till, deposited chiefly by direct action of glacier ice, in a variety of topographic landforms that are independent of control by the surface on which the drift lies.

MUSKEG - A bog, usually a sphagnum bog, frequently with grassy tussocks, growing in wet, poorly drained, boreal regions, often areas of permafrost.

NATURAL AREA - An area of land or water that has retained its wilderness character, although not necessarily completely natural and undisturbed, or that has rare or vanishing flora, fauna, archaeological, scenic, historical, or similar features of scientific or educational value.

NET PRECIPITATION - Precipitation minus evaporation.

OLIVINE - An olive-green, grayish-green, or brown orthorhombic mineral: $(Mg, Fe)_2 SiO_4$.

ORGANIC - Pertaining or relating to a compound containing carbon, especially as an essential component.

OUTWASH PLAIN - A broad, gently sloping sheet of outwash deposited by meltwater streams flowing in front of or beyond a glacier, and formed by coalescing outwash fans.

PARK - An area of public land known for its natural scenery and preserved for public recreation by a State or national government.

PHENOCRYST - A relatively large, conspicuous crystal in a porphyritic rock.

PLAGIOCLASE - A group of triclinic feldspars of the general formula: $(Na, Ca) Al (Si, Al) Si_2O_8$.

PLAIN - Any flat area at a low elevation.

POLYCHLORINATED BIPHENYLS (PCBs) - A family of aromatic hydrocarbons in which chlorine atoms have replaced the hydrogen atoms in biphenyl rings. At least 100 different compounds are known as PCBs; these differ in their toxic effects as well as in their chemical and physical properties. PCBs were widely used as insulating fluids in electrical transformers and capacitors.

PORPHYRITIC - Said of the texture of an igneous rock in which larger crystals (phenocrysts) are set in a finer-grained ground mass, which may be crystalline or glassy.

PRESERVE - An area maintained and protected especially for regulated hunting and fishing.

PRISTINE - Something that is still pure or untouched; uncorrupted; unspoiled.

PUMICE - A light-colored vesicular glassy rock commonly having the composition of rhyolite.

PUSH MORAINE - A broad, smooth, arc-shaped morainal ridge consisting of material mechanically pushed or shoved along by an advancing glacier.

QUARTZ - A crystalline silica, an important rock forming mineral: SiO_2. Occurs either in transparent hexagonal crystals (colorless or colored by impurities) or in crystalline masses. Forms the major proportion of most sands and has a widespread distribution in igneous, metamorphic, and sedimentary rocks.

RECENT - An epoch of the Quaternary period which covers the span of time from the end of the Pleistocene epoch, approximately 8 thousand years ago, to the present. Also called the Holocene epoch.

RECESSIONAL MORAINE - An end or lateral moraine built during a temporary but significant pause in the final retreat of a glacier.

RECHARGE AREA - An area in which water is absorbed that eventually reaches the zone of saturation in one or more aquifers.

RHYOLITE - A group of extrusive igneous rocks, typically porphyritic; the extrusive equivalent of granite.

RIDGE - A general term for a long, narrow elevation of the Earth's surface, usually sharp-crested with steep sides, occurring either independently or as part of a larger mountain or hill.

ROCK - An aggregate of one or more minerals; or a body of undifferentiated mineral matter or of solid organic material.

RUBBLE - A loose mass of angular rock fragments, commonly overlying outcropping rock.

SCARP - A line of cliffs produced by faulting or by erosion.

SEDIMENT - Solid fragmental material that originates from weathering of rocks and is transported or deposited by air, water, or ice, or that accumulates by other natural agents, such as chemical precipitation from solution or secretion by organisms, and that forms in layers on the Earth's surface at ordinary temperatures in a loose, unconsolidated form; (b) strictly solid material that has settled down from a state of suspension in a liquid.

SILT [geol] - A rock fragment or detrital particle smaller than a very fine sand grain and larger than coarse clay, having a diameter in the range of 0.004 to 0.063 mm.

SLOPE - (a) Gradient; (b) The inclined surface of any part of the Earth's surface.

SOIL PERMEABILITY - The characteristic of the soil that enables water to move downward through the profile. Permeability is measured as to the number of inches per hour that water moves downward through the saturated soil.

Terms describing permeability are:

Very Slow	- less than 0.06 inches per hour (less than 4.24×10^{-5} cm/sec)
Slow	- 0.06 to 0.20 inches per hour (4.24×10^{-5} to 1.41×10^{-4} cm/sec)

Moderately Slow	- 0.20 to 0.63 inches per hour (1.41×10^{-4} to 4.45×10^{-4} cm/sec)
Moderate	- 0.63 to 2.00 inches per hour (4.45×10^{-4} to 1.41×10^{-3} cm/sec)
Moderately Rapid	- 2.00 to 6.00 inches per hour (1.41×10^{-3} to 4.24×10^{-3} cm/sec)
Rapid	- 6.00 to 20.00 inches per hour (4.24×10^{-3} to 1.41×10^{-2} cm/sec)
Very Rapid	- more than 20.00 inches per hour (more than 1.41×10^{-2} cm/sec)

(Reference: U.S.D.A. Soil Conservation Service)

SOIL REACTION - The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests at pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

SOIL STRUCTURE - The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are -- platty (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

SPRUCE - Any of a genus (Picea) of evergreen trees of the pine family.

STADE - A substage of a glacial stage marked by a glacial readvance.

STRATIFIED - Formed, arranged, or laid down in layers or strata; especially said of any layered sedimentary rock or deposit.

STREAM - Any body of running water that moves under gravity to progressively lower levels, in a relatively narrow but clearly defined channel on the surface of the ground; smaller than river; Syn : brook.

STREAM BED - The channel containing or formerly containing the water of a stream.

SURFACE WATER - All water exposed at the ground surface, including streams, rivers, ponds, and lakes.

SURFICIAL - Pertaining to, or occurring on, a surface. Syn: superficial.

SWAMP - An area intermittently or permanently covered with water, having shrubs and trees but essentially without the accumulation of peat.

TALUS SLOPE - A steep, concave slope formed by an accumulation of loose rock fragments, especially such a slope at the base of a cliff.

TERRACE - Any long, narrow, relatively level or gently inclined surface, generally less broad than a plain, bounded along one edge by a steeper descending slope and along the other by a steeper ascending slope.

TERTIARY - The first period of the Cenozoic era, thought to have covered the span of time between 65 and 3 to 2 million years ago.

THREATENED SPECIES - Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

TILL - Dominantly unsorted and unstratified drift, generally unconsolidated, deposited directly by and underneath a glacier without subsequent reworking by meltwater, and consisting of a heterogenous mixture of clay, silt, sand and gravel and boulders ranging widely in size and shape

TOPOGRAPHY - The general conformation of a land surface, including its relief and the position of its natural and manmade features.

TREELINE - The elevation or the latitudinal limits at which tree growth stops.

TUFF - A general term for all consolidated pyroclastic rocks.

TUNDRA - A rolling, treeless, often marshy plain of arctic regions.

UNCONSOLIDATED MATERIAL - A sediment that is loosely arranged or whose particles are not cemented together, occurring either at the surface or at depth.

VALLEY FILL - The unconsolidated sediment deposited by any agent so as to fill or partially fill a valley.

VESICULAR - Said of the texture of a rock, especially a lava, characterized by abundant vesicles formed as a result of the expansion of gases during the fluid stage of the lava.

VOLCANIC - Igneous rocks that have reached the earth's surface before solidifying; generally finely crystalline or glassy.

VOLCANIC ASH - Fine pyroclastic material; less than 2.0 mm in diameter.

VOLCANICLASTIC - Pertaining to a clastic rock containing volcanic material in whatever proportion, without regard to its origin or environment.

WATER TABLE - The surface between the zone of saturation and the zone of aeration; that surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere.

WAVE-CUT - Carved or cut away by the sea waves, assisted by their currents.

WETLANDS - Are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of the Classification of Wetlands and Deepwater Habitats of the United States, wetlands must have one or more of the following three attributes: (1) at least periodically , the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.

WILDERNESS AREA - An area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this chapter of the Wilderness Act, an area of underdeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or an primitive and unconfined type of recreation; (3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic or historical value.

WILLOW - Any of a large genus (Salix) of shrubs and trees having generally smooth branches.

ZEOLITE - A large group of white or colorless (sometimes red or yellow) hydrous aluminosilicates that are analogous in composition to the feldspars, with sodium, calcium, and potassium (rarely barium or strontium) as their chief metals; have a ratio of (Al + Si) to nonhydrous oxygen of 1.2; and are characterized by their easy and reversible loss of water of hydration and by their ready fusion and swelling when strongly heated under the blowpipe. Zeolites have long been known to occur as well-formed crystals in cavities in basalt.

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APPENDIX A

RESUMES OF PRELIMINARY ASSESSMENT TEAM MEMBERS

LAWRENCE E. GLADSTONE

EDUCATION

B.S., Geophysics, Virginia Polytechnic Institute & State University, 1985

EXPERIENCE

Two years' experience as junior staff scientist for the Hazardous Materials Technical Center of Dynamac Corporation. Experience in hazardous waste management includes conducting Phase I records searches for the Air National Guard's Installation Restoration Program, auditing records of waste management firms awarded disposal contracts by DoD, and preparing RCRA Part B permit applications for the Defense Reutilization and Marketing Service (DRMS).

EMPLOYMENT

<u>Dynamac Corporation (1986-present)</u>: Junior Staff Scientist

Performs preliminary assessments of suspected hazardous waste sites at Air National Guard bases under Phase I of the Installation Restoration Program. Duties include searching available records, interviewing past and present employees, observing current waste management practices, and investigating identified spill/disposal sites.

Prepares RCRA Part B permits for hazardous waste storage facilities operated by DRMS.

Prepared Air Force's response to EPA CERCLA 104(e) letters regarding wastes generated by Luke and Altus Air Force Bases which may have been disposed at landfill facilities subsequently identified as Superfund sites requiring remedial action.

Developed closure maintenance plans for landfill cells at Edwards Air Force Base.

Conducted surveillance of hazardous waste contractors for DRMS. Responsibilities included auditing waste records, tracking fate of disposed items, and monitoring contractor operations.

Assisted in development of data base designed to reveal disposal costs of waste generated at Defense Reutilization and Marketing Offices.

<u>U.S. Geological Survey (part-time, 1983-1985)</u>: Cartographic Aide

Assisted in quality control process of printing and distributing 7-1/2 minute topographic maps. Checked and corrected map separate registration, organized negative and positive overlays for alignment, and prepared photographic service requests.

RAYMOND G. CLARK, JR.

EDUCATION

Completed graduate engineering courses, George Washington University, 1957
B.S., Mechanical Engineering, University of Maryland, 1949

SPECIALIZED TRAINING

Grad. European Command Military Assistance School, Stuttgart, 1969
Grad. Army Psychological Warfare School, Fort Bragg, 1963
Grad. Sanz School of Languages, D.C., 1963
Grad. DOD Military Assistance Institute, Arlington, 1963
Grad. Defense Procurement Management Course, Fort Lee, 1960
Grad. Engineer Officer's Advanced Course, Fort Belvoir, 1958

CERTIFICATIONS

Registered Professional Engineer: Kentucky (#4341); Virginia (#8303); Florida (#36228)

EXPERIENCE

Thirty-one years of experience in engineering design, planning and management including construction and construction management, environmental, operations and maintenance, repair and utilities, research and development, electrical, mechanical, master planning and city management. Over six years' logistical experience including planning and programming of military assistance materiel and training for foreign countries, serving as liaison with American private industry, and directing materiel storage activities in an overseas area. Over two years' experience as an engineering instructor. Extensive experience in personnel management, cost reduction programs, and systems improvement.

EMPLOYMENT

Dynamac Corporation (1986-present): Program Manager/Department Manager

Responsible for activities relating to Preliminary Analysis, Site Investigations, Remedial Investigations, Feasibility Studies, and Remedial Action for the Installation Restoration Program for the U.S. Air Force, Air National Guard, Bureau of Prisons, and the U.S. Coast Guard, including records search, review and evaluation of previous studies; preparation of statements of work, feasibility studies; preparation of remedial action plans, designs and specifications; review of said studies/plans to ensure that they are in conformance with requirements; review of environmental studies and reports; preparation of Air Force Installation Restoration Program Management Guidance; and preparation of Part B permits.

Howard Needles Tammen & Bergendoff (HNTB) (1981-1986): Manager

Responsible, as Project Manager, for: design of a new concourse complex at Miami International Airport to include terminal building, roadway system, aircraft apron, drainage channel relocation, satellite building with underground pedestrian tunnel, and associated underground utility corridors, to include subsurface aircraft fueling systems, with an estimated construction cost of $163 million; a cargo vehicle tunnel under the crosswind runway with an estimated construction cost of $15 million; design and construction of two large corporate jet aircraft hangars; and for the hydrocarbon recovery program to include investigation, analysis, design of recovery systems, monitoring of recovery systems, and planning and design of residual recovery systems utilizing biodegradation. Participated, as sub-consultant, in Air Force IRP seminar.

HNTB (1979-1981): Airport Engineer

Responsibilities included development of master plan for Iowa Air National Guard base; project initiation assistance for a new regional airport in Florida; engineering assistance for new facilities design and construction for Maryland Air National Guard; master plan for city maintenance facilities, Orlando, Florida; in-country master plan and preliminary engineering project management for Madrid, Spain, International Airport; and project management of master plan for Whiting Naval Air Station and outlying fields in Florida.

HNTB (1974-1979): Design Engineer

Responsibilities included development of feasibility and site selection studies for reliever airports in Cleveland and Atlanta; site selection and facilities requirements for the Office of Aeronautical Charting and Cartography, NOAA; and onsite mechanical and electrical engineering design for terminal improvements at Baltimore-Washington International Airport, Maryland.

HNTB (1972-1974): Airport Engineer

Responsible for development of portions of the master plan and preliminary engineering for a new international airport for Lisbon, Portugal, estimated to cost $250 million.

Self-employed (1971-1972): Private Consultant

Responsible for engineering planning and installation of a production line for multimillion-dollar contract in Madrid, Spain, to fabricate transmissions and differentials for U.S. Army vehicles.

U.S. Army, Corps of Engineers (1969-1971): Chief, Materiel & Programs

Directed materiel planning and military training programs of military assistance to the Spanish Army. Controlled arrival and acceptance of materiel by host government. Served as liaison/advisor to American industry interested

in conducting business with Spanish government. Was Engineer Advisor to Spanish Army Construction, Armament and Combat Engineers, also the Engineer Academy and Engineer School of Application.

Corps of Engineers (1968-1969): Chief, R&D Branch, OCE

Directed office responsible to Chief of Engineers for research and development. Developed research studies in new concepts of bridging, new explosives, family of construction equipment, night vision equipment, expedient airfield surfacing, expedient aircraft fueling systems, water purification equipment and policies, prefabricated buildings, etc. Achieved Department of Army acceptance for development and testing of new floating bridge. Participated in high-level Department Committee charged with development of a Tactical Gap Crossing Capability Model.

Corps of Engineers (1967-1968): Division Engineer

Facilities engineer in Korea. Was fully responsible for management and maintenance of 96 compounds within 245 square miles including 6,000+ buildings, 1 million linear feet of electrical distribution lines, 18 water purification and distribution systems, sanitary sewage disposal systems, roads, bridges, and fire protection facilities with real property value of more than $256 million. Planned and developed the first five-year master plan for this area. Administered $12 million budget and $2 million engineer supply operation. Was in responsible charge of over 500 persons. Developed and obtained approval for additional projects worth $9 million for essential maintenance and repair. Directed cost reduction programs that produced more than $500,000 savings to the United States in the first year.

Corps of Engineers (1963-1967): Engineer Advisor

Engineer and aviation advisor to the Spanish Army. Developed major modernization program for Spanish Army Engineers, including programming of modern engineer and mobile maintenance equipment. Directed U.S. portion of construction, testing and acceptance of six powder plants, one shell loading facility, an Engineer School of Application, and depot rebuild facilities for engineer, artillery, and armor equipment. Planned and developed organization of a helicopter battalion for the Spanish Army. Responsible for sales, delivery, assembly and testing of 12 new helicopters in country. Provided U.S. assistance to unit until self-sufficiency was achieved. Was U.S. advisor to Engineer Academy, School of Application and Polytechnic Institute.

Corps of Engineers (1960-1963): Deputy District Engineer

Responsible for planning and development of extensive construction projects in the Ohio River Basin for flood control and canalization, including dam, lock, bridge, and building construction, highway relocation, watershed studies, real estate acquisitions and dispositions. Was contracting officer for more than $75

million of projects per year. Supervised approximately 1,300 personnel, including 300 engineers. Planned and directed cost reduction programs amounting to more than $200,000 per year. Programmed and controlled development of a modern radio and control net in a four-state area.

Corps of Engineers (1959-1960): Area Engineer

Directed construction of a large airfield in Ohio as Contracting Officer's representative. Assured that all construction (runway, steam power plant, fuel transfer and loading facilities, utilities, buildings, etc.) complied with terms of plans and specifications. Was onsite liaison between Air Force and contractors.

Corps of Engineers (1958-1959): Chief, Supply Branch

Managed engineer supply yard containing over $21 million construction supplies and engineer equipment. Directed in-storage maintenance, processing and deprocessing of equipment. Achieved complete survey of items on hand, a new locator system and complete rewarehousing, resulting in approximately $159,000 savings in the first year.

Corps of Engineers (1957-1958): Student

U.S. Army Engineer School, Engineer Officer's Advanced Course.

Corps of Engineers (1954-1957): Engineer Manager

Managed engineer construction projects and was assigned to staff and faculty of the Engineer School. Was in charge of instruction on engineer equipment utilization, management and maintenance. Directed Electronic Section of the school. Coordinated preparation of five-year master plan for the Department of Mechanical and Technical Equipment.

Corps of Engineers (1949-1954): Engineer Commander

Positions of minor but increasing importance and responsibility in engineering management, communications, demolitions, construction administration and logistics.

PROFESSIONAL AFFILIATIONS

Member, National Society of Professional Engineers
Fellow, Society of American Military Engineers
Member, American Society of Civil Engineers
Member, Virginia Engineering Society
Member, Project Management Institute

HARDWARE

IBM PC

SOFTWARE

Lotus 1-2-3, D Base III Plus, Framework, Project Scheduler 5000, Harvard Project Manager, Volkswriter, Microsoft Project

BETSY A. BRIGGS

EDUCATION

B.S., Biology and Chemistry, State University College of New York at Cortland, 1979

Completed several courses in M.B.A. program, University of Phoenix, Denver, Colorado Division, 1984

SPECIALIZED TRAINING

Hazardous Waste Management course, Air Force Institute of Technology, 1986

CERTIFICATION

Certified Hazardous Materials Manager, Institute of Hazardous Materials Management, 1985

SECURITY CLEARANCE

Secret/DOE

EXPERIENCE

Nine years of experience including three years in hazardous waste management, two years as an environmental engineer, two years as an ecologist, and two years in laboratory research. Has conducted ambient air quality monitoring programs, critical pathways projects to study movement of radioactive materials in the environment, metallurgic laboratory analyses, and independent studies in biology and chemistry. Currently provides managerial oversight and technical support to a hazardous waste program for the Air Force.

EMPLOYMENT

Dynamac Corporation (1985-present): Program Manager/Hazardous Waste Specialist

Primary responsibility as program manager is to oversee and manage up to 44 field personnel involved in RCRA and CERCLA work in support of the U.S. Air Force. Other duties include performing preliminary assessments/site surveys for the Air National Guard, marketing and proposal preparation, and preparing and providing training in preparation for the Certified Hazardous Materials Manager examination.

As hazardous waste specialist the primary responsibility was to manage the hazardous waste program at Myrtle Beach Air Force Base. Duties included:

- o Reviewing the design and specifications of various base construction projects and overseeing such projects to ensure compliance with all applicable state and federal hazardous waste regulations. Projects under design included a corrosion control facility, TSD facility, two accumulation points, and a parts cleaning vat system. Construction project oversight included the final inspection of the entomology building to ensure that the facility was equipped for proper storage, usage and disposal of pesticides; removal of materials contaminated with pesticides, PCBs, petroleum products, and solvents from six sites; asbestos removal and disposal from a former hangar site; and the removal of two underground storage tanks, one of which was leaking.
- o Conducting surveys of hazardous waste generating activities.
- o Advising on need for and methods of minimizing hazardous waste generation.
- o Writing and maintaining hazardous waste management plan.
- o Preparing hazardous waste management reports and documents required by state and federal law.
- o Maintaining liaison with federal and state regulatory agencies on matters involving criteria, standards, performance specifications, and monitoring.
- o Providing information and technical consultation to Air Force installation staff regarding hazardous materials and hazardous waste operations.
- o Serving as ad hoc advisor to environmental contingency response teams.

<u>Rockwell International (1982-1984)</u>: Environmental Engineer

Primary responsibility was collection, evaluation, and reporting of ambient air monitoring data. Other responsibilities included technical assistance for monitoring total suspended solids in ambient air. Also performed data collection and reduction of air effluent emission control activities.

Environmental monitoring and control programs are to ensure that all Department of Energy and other governmental effluent regulations are met, and that plant effluents are consistent with the As Low As Reasonably Achievable (ALARA) Principle. Monthly and Annual Reports summarize the effluent and environmental monitoring programs.

<u>Rockwell International (1980-1982)</u>: Ecologist

Responsible for planning, organizing, and leading critical pathways projects designed to study the movement of radioactive materials throughout the environment. Projects were: (1) general critical pathway evaluation to identify

sampling points possibly not considered in present monitoring program; (2) plant uptake versus plant uptake plus foliar deposition measurement study; (3) deer tissue analysis program; and (4) food stuff monitoring program. Progress and results were published in semiannual reports.

Colorado School of Mines Research Institute, Texas Gulf Research Laboratory (1979-1980): Senior Laboratory Technician

Work involved quantitative analysis of platinum, palladium, and silver in soil samples. Analysis included sample preparation, fire assays, calorimetric procedures, and smelt tests.

State University College of New York at Cortland (1978-1979): Undergraduate Independent Study

Project involved the isolation of trail pheromone from spun silk of *Hyphantria* (fall webworm). Included organic and inorganic extraction procedures and performing bioassays. Also worked on production of synthetic diet comparable to fresh leaf diet for *Malacosomo* (eastern tent caterpillar).

PUBLICATIONS

Hazardous Waste Management Survey for Myrtle Beach Air Force Base, Hazardous Materials Technical Center, Rockville, Maryland, 1986 and 1988.

Hazardous Waste Management Plan for Myrtle Beach Air Force Base, Hazardous Materials Technical Center, Rockville, Maryland, 1987 and 1988.

Waste Minimization Guidance for Myrtle Beach Air Force Base, Hazardous Materials Technical Center, Rockville, Maryland, 1988.

Underground Storage Tank Management Plan for Myrtle Beach Air Force Base, Hazardous Materials Technical Center, Rockville, Maryland, 1988.

Annual Environmental Monitoring Report, Rockwell International, Energy Systems Group, Rocky Flats Plant, 1982 and 1983.

Environmental Studies Group Semiannual Report, Rockwell International, Energy Systems Group, Rocky Flats Plant, June/December of 1980 and 1981.

TECHNICAL PRESENTATIONS

PCB Management, Myrtle Beach Air Force Base, 1987.

Underground Storage Tank Regulations/History, Myrtle Beach Air Force Base, 1986.

Overview of the Hazardous Waste Training Program, Myrtle Beach Air Force Base, 1985.

Overview of the Environmental Studies Group, Nevada Test Site and Rockwell International at Hanford, Washington, 1981.

NATASHA M. BROCK

EDUCATION

Graduate work, civil/environmental engineering, University of Maryland, 1987-present
Graduate work, civil/environmental engineering, University of Delaware, 1985-1986
B.S. (cum laude), environmental science, University of the District of Columbia, 1984
Undergraduate work, biology, The American University, 1978-1980

CERTIFICATION

Health & Safety Training Level C

EXPERIENCE

Three years' experience in the environmental and hazardous waste field. Work performed includes remedial investigations/feasibility studies, RCRA facility assessments, comprehensive monitoring evaluations, and remedial facility investigations. Helped develop and test biological and chemical processes used in minimization of hazardous and sanitary waste generation. Researched multiple substrate degradation using aerobic and anaerobic organisms.

EMPLOYMENT

Dynamac Corporation (1987-present): Environmental Scientist

In working for Dynamac's Hazardous Materials Technical Center (HMTC), performs Preliminary Assessments, Remedial Investigations and Feasibility Studies (PA/RI/FS) under the Air National Guard Installation Restoration Program. Specifically involved in determining rates and extent of contamination, recommending groundwater monitoring procedures, and soil sampling and analysis procedures. In the process of preparing standard operating procedure manuals for quick remedial response to site spills and releases, and PA/RI/FS.

C.C. Johnson & Malhotra, P.C. (1986-1987): Environmental Scientist

Involved as part of a team in performing Remedial Investigations/Feasibility Studies (RI/FS) for EPA Regions I and IV under Resource Conservation and Recovery Act (RCRA) work assignments for REM II projects. Participated on a team involved in RCRA Facility Assessments (RFAs), Comprehensive Monitoring Evaluations (CMEs), and Remedial Facility Investigations (RFIs) for EPA work assignments under RCRA for REM III projects in Regions I and IV. Work included solo oversight observations of field sampling and facility inspections. Additional responsibilities included promotion work, graphic layout, data entry-quality check for various projects. Certified Health & Safety Training Level C.

Work Force Temporary Services (1985-1986): Research Scientist

In working for DuPont's Engineering Test Center, helped in the development and testing of laboratory-scale biological and chemical processes for a division whose main purpose was to reduce the amount of hazardous waste generated. Also worked for Hercules, Inc., with a group involved in polymer use for wastewater treatment for clients in various industrial fields. Specifically involved in product consultation, troubleshooting, and product development.

National Oceanic and Atmospheric Administration (1982-1984): Research Assistant

Involved with an information gathering and distribution center of weather impacts worldwide. Specifically involved in data collection, distribution of data to clients, assessment production and special reports.

DAVID R. HALE

EDUCATION

B.S., Civil Engineering, Virginia Polytechnic Institute, 1978

SPECIALIZED TRAINING

Groundwater Remediation Course, National Water Well Association, 1986
Contract Supervisor School, CBI Industries, 1981

CERTIFICATION

Engineer-in-Training Certificate, State of Virginia, 1978

EXPERIENCE

Ten years' experience in a wide variety of engineering planning, design and management, environmental assessment and remediation, project and construction management, as well as research and development activities related to new and innovative technologies. Experience includes involvement in small-, medium- and large-scale environmental and civil projects, and includes project conception, design, implementation, construction and management activities. Extensive experience in the development, design and management of projects involving several interdisciplinary fields of engineering, sciences, and business. Proficiency in a wide variety of computer systems and usage, including mainframe and microcomputers as well as CAD systems.

EMPLOYMENT

Dynamac Corporation (1987-present): Manager of Engineering

Responsible for the engineering management of various environmental consulting engineering and technical services in the Dayton regional office. Responsibilities include the planning, development, and execution of engineering and technical services for environmental projects such as hazardous waste site investigations and remediation, asbestos assessment and abatement, RCRA permitting, monitoring and compliance, industrial hygiene and training, as well as other environmental matters.

DETOX, Inc. (1986): Manager, Technical Services

Responsible for the overall development, design, project management and implementation of various groundwater remediation projects, as well as several specialized wastewater treatment systems. Heavy emphasis on the conceptual development and design engineering related to innovative biological treatment techniques, equipment and systems, as well as multiunit process water and

wastewater treatment systems. Staff management responsibilities included supervision of engineering, procurement, and large-scale project management functions, as well as direct involvement in project marketing, corporate computer and CAD operations, and company R&D efforts.

DETOX, Inc. (1985-1986): Eastern Regional Manager

As regional manager for the eastern United States, responsibilities included the overall marketing, sales, and project management for groundwater remediation and industrial wastewater projects in this area. Efforts resulted in establishing a widespread customer interest base for the groundwater treatment equipment and technical services offered by DETOX, as well as sale and management of several substantial and innovative remediation projects. Instituted corporatewide microcomputer-based CAD and project management systems.

CBI Industries, Inc. (1981-1985): Project Engineer

As part of a new Water Technology Development venture group (1984-1985), involved in actively researching, seeking, and implementing for CBI new and innovative technologies and business lines. Responsibilities included acquisition research, engineering and financial analysis and assessment, market research, and business development. Two new business line developments resulted in $15 million to $20 million in annual revenues. Actively pursued several new business areas for CBI, including the privitization of municipal water and wastewater facilities, and sewage sludge composting. Initiated CBI interest in co-development of a new, innovative flue gas treatment technology for reducing acid-rain-causing emissions from fossil fuel combustion processes. Awarded one patent, with two pending applications, as a result of activities in the Water Technology group.

Project engineer assigned to various CBI Industries engineering departments (Special Structures, Standard Structures, and Marine Structures) (1981-1984); involved in the design and analysis of several substantial projects. These included the conception and design of two new and innovative offshore oil exploration drilling structures for use in Alaskan Arctic waters, with a patent award for one concept. Responsible for the external structural analysis and design on CBI's largest ever project, a turnkey LGN/LPG facility in excess of $350 million.

CBI Industries, Inc. (1979-1981): Project Engineer/Field Engineer

Assigned to CBI's Saudi Arabian construction subsidiary (Arabian CBI); worked as project and field engineer on several substantial field construction projects, including two refinery tankage terminals (a total of 120 petroleum tanks) and several refinery vessels and miscellaneous structures. Involved in the day-to-day management of large-scale field construction projects, including the close supervision and management of large numbers of field employees from several diverse nationalities. Responsible for the field engineering aspects of large petrochemical projects, including field layout, surveying, and erection supervision.

CBI Industries, Inc. (1978-1979): Engineer Trainee

Worked at CBI's Delaware Engineering Office and Pennsylvania Manufacturing Plant as part of CBI's Engineer Advancement Program. Duties included familiarization with CBI procedures related to detail engineering and manufacturing, as well as hands-on training in such areas as welding, fabrication, and engineering drawing.

PUBLICATIONS

Hale, D.R., and E.K. Nyer. 1986. Two Years of Operation of a Groundwater Treatment System, Proceedings of the 1986 ASCE National Conference on Environmental Engineering.

Hale, D.R., et al. Physical/chemical in-situ treatment techniques. Chapter 10 in: In-situ Treatment Technology (in press).

TECHNICAL PRESENTATIONS

Instructor on Groundwater Treatment Technology, 1986 Aquifer Remediation Course Series presented by the National Water Well Association

Instructor on Groundwater Treatment Technology, 1986 HazPro Professional Certification Symposium

MARK D. JOHNSON

EDUCATION

B.S., Geology, James Madison University, 1980

EXPERIENCE

Eight years' technical and management experience including geologic mapping, subsurface investigations, foundation inspections, groundwater monitoring, pumping and observation well installation, geotechnical instrumentation, groundwater assessment, preparation of Air Force Installation Restoration Program Guidance, preparation of statements of work for environmental field monitoring and feasibility studies for the Air Force and the Air National Guard, development of environmental field monitoring programs, and preparation of Preliminary Assessments for the Air National Guard.

EMPLOYMENT

Dynamac Corporation (1984-present): Senior Staff Scientist/Geologist

Primarily responsible for developing and managing technical support programs relevant to CERCLA related activities for the Air Force, Air National Guard, Department of Justice and Coast Guard. These activities include Statements of Work for Site Investigations (SI), Remedial Investigations (RI), and Feasibility Studies (FS); assessing groundwater at hazardous waste disposal/spill sites for the purpose of determining rates and extents of contaminant migration and for developing SI and RI programs and identifying remedial actions; reviewing SI, RI and FS contractor work plans for various government clients, developing technical and contractual requirements for SI, RI and FS projects, managing the development and preparation of Preliminary Assessments, and assisting clients in the development of their environmental management programs, which included preparation of the Air Force's Installation Restoration Program Management Guidance document.

Bechtel Associates Professional Corporation (1981-1984): Geologist

Performed the following duties in conjunction with major civil engineering projects including subways, nuclear power plants and buildings: prepared geologic maps of surface and subsurface facilities in rock and soil including tunnels, foundations and vaults; assessed groundwater conditions in connection with construction activities and groundwater control systems; monitored the installation of permanent and temporary dewatering systems and observation wells; monitored surface and subsurface settlement of tunnels; and participated in subsurface investigations.

Schnabel Engineering Associates (1981): Geologist

Inspected foundations and backfill placement.

PROFESSIONAL CREDENTIALS

Registered Professional Geologist, South Carolina, #116, 1987

PROFESSIONAL AFFILIATIONS

Association of Engineering Geologists
National Water Well Association/Association of Ground Water Scientists and Engineers

GRACE E. HILL

EDUCATION

B.S. (enrolled), Environmental Science, University of the District of Columbia
A.S., Marine Science, University of the District of Columbia, 1984

CERTIFICATION

Health & Safety Training Level C

EXPERIENCE

Seven years of experience in various environmental and hazardous waste disciplines including Preliminary Assessments, Remedial Investigations, and Feasibility Studies at Superfund sites, RCRA Facility Assessments, Initial Assessment Studies under the Naval Environmental Energy Study Assessment (NEESA), Region IV Compliance investigation for subsequent legal actions, Information Specialist for the EPA/Superfund Hotline, and assisting in the management of REM/FIT zone contracts.

Performed as task leader for the Blue Plains WWTP Biomonitoring Project consisting of laboratory setup, monitoring test organisms, conducting toxicity tests, and preparation of weekly and monthly reports.

EMPLOYMENT

Dynamac Corporation (1988-present): Environmental Scientist

In working for Dynamac's Hazardous Materials Technical Center (HMTC), performs Preliminary Assessments, Remedial Investigations, and Feasibility Studies (PA/RI/FS) under the Air National Guard Installation Restoration Program. Specifically involved in preparing reports detailing site investigation findings, determining rates and extent of contamination, and recommendations for Phase II monitoring and soil sampling.

Participated in a remedial investigation/feasibility study at a Superfund site in Puerto Rico to ascertain the alleged extent of mercury contamination.

C.C. Johnson & Malhotra, P.C. (1985-1988): Environmental Technician

Task leader for the Blue Plains WWTP Biomonitoring Project consisting of laboratory setup, monitoring test organisms, conducting toxicity tests, and preparation of weekly and monthly reports. Participated in groundwater monitoring, well installation and development at Independent Nail, SC, Superfund site. Conducted RCRA Facility Assessments (RFAs) under EPA's REM III Project for Regions I and IV. Performed literature search, site investigations, sample collection, CLP coordination, health and safety plan

preparation, data analysis, and document preparation. Participated on a team involved in the research and organization of compliance documents for subsequent legal actions. Participated in the preparation of an RI/FS consisting of surveying and soil, sediment, surface water and groundwater sampling, groundwater contamination migration determination, and residential well sampling at Geiger C&M Oil, SC, DeRewal, NJ, and Limestone Road, MD, Superfund sites. Assisted in the final preparation of the Initial Assessment Studies under the Navy's hazardous waste control program (NEESA) at three Navy facilities.

Geo/Resource Consultants (1984-1985): Environmental Assistant

Information Specialist for the EPA's RCRA/Superfund Hotline involved in technical assistance regarding federal and state regulations and the requirements necessary for the management of hazardous waste, for industry and the public.

Environmental Protection Agency (1981-1984): Intern

As an environmental intern, assisted Field Investigation Team (FIT) Deputy Project Officers in the management of REM/FIT zone contracts. Specifically involved in the evaluation of completed FIT projects, assistance in the award fee process, evaluation of FIT well drilling procedures, development of analytical documents for RCRA 3012 Cooperative Agreement Program, involving the development of a tracking system of the State agencies use of funds for hazardous waste cleanup.

JANET SALYER EMRY

EDUCATION

M.S., geology, Old Dominion University, 1987
B.S. (cum laude), geology, James Madison University, 1983

EXPERIENCE

Three years' technical experience in the fields of hydrogeology and environmental science, including drilling and placement of wells, well monitoring, aquifer testing, determination of hydraulic properties, computer modeling of aquifer systems, and field and laboratory soils analysis.

EMPLOYMENT

Dynamac Corporation (1987-present): Staff Scientist/Hydrogeologist

Responsibilities include Preliminary Assessments, Site Investigations, Remedial Investigations, Feasibility Studies, and Emergency Responses to include providing geological and hydrological assessments of hazardous waste disposal/spill sites, determination of rates and extents of contaminant migration, and computer modeling of groundwater flow and contaminant transport. Projects are for the U.S. Air Force and Air National Guard Installation Restoration Program.

Froehling and Robertson, Inc. (1986-1987): Geologist/Engineering Technician

Performed both field and laboratory engineering soils tests.

The Nature Conservancy (1985-1986): Hydrogeologist

Investigated groundwater geology of the Nature Conservancy's Nags Head Woods Ecological Preserve in Dare County, North Carolina. Study included installing wells, monitoring water table levels, determination of hydraulic parameters through a pumping test, stratigraphic test borings, and computer modeling.

Old Dominion University (1983-1985): Teaching Assistant, Department of Geological Sciences

Taught laboratory classes in Earth Science and Historical Geology.

PROFESSIONAL AFFILIATIONS

Geological Society of America
National Water Well Association/Association of Ground Water Scientists and Engineers

PUBLICATION

Impact of Municipal Pumpage Upon a Barrier Island Water Table, Nags Head and Kill Devil Hills, North Carolina. In: Abstracts with Programs, Geological Society of America, Vol. 19, No. 2, February 1987.

APPENDIX B

OUTSIDE AGENCY CONTACT LIST

OUTSIDE AGENCY CONTACT LIST

Alaskan Department of Environmental Conservation
3601 C Street, Suite 1350
Anchorage, AK 99508
Bruce Erickson and James Hayden, (907) 563-6529

Arctic Environmental Information and Data Center
University of Alaska - Fairbanks
707 A Street
Anchorage, AK 99501

National Oceanic and Atmospheric Administration
6001 Executive Boulevard
Rockville, MD 20853

National Oceanic and Atmospheric Administration
701 C Street, Box 38
Anchorage, AK 99513
(907) 271-5040

State of Alaska Department of Natural Resources
Division of Geological and Geophysical Surveys
3700 Airport Way
Fairbanks, AK 99709-4609
Mark Robinson (907) 474-7147

U.S. Fish and Wildlife Services
1011 East Tudor Road
Anchorage, AK
Ronald Garrett, (907) 786-3435

U.S. Fish and Wildlife Service
1412 Airport Way
Fairbanks, AK 99701-8524
R.E. (Skip) Ambrose, (907) 456-0239

U.S. Geological Survey
12201 Sunrise Valley Drive
Reston, VA 22092

U.S. Geological Survey
4200 University Drive
Anchorage, AK 99508
Oscar J. Ferrians, Jr., (907) 561-1181

U.S. Soil Conservation Service
201 East 9th Avenue, Suite 300
Anchorage, AK
(907) 271-2424

APPENDIX C

USAF HAZARD ASSESSMENT RATING METHODOLOGY AND GUIDELINES

USAF HAZARD ASSESSMENT RATING METHODOLOGY

The Department of Defense (DoD) has established a comprehensive program to identify, evaluate, and control problems associated with past disposal practices at DoD facilities. One of the actions required under this program is to:

> develop and maintain a priority listing of contaminated installations and facilities for remedial action based on potential hazard to public health, welfare, and environmental impacts (Reference: DEQPPM 81-5, 11 December 1981).

Accordingly, the United States Air Force (USAF) has sought to establish a system to set priorities for taking further actions at sites based upon information gathered during the Preliminary Assessment phase of its Installation Restoration Program (IRP).

PURPOSE

The purpose of the site rating model is to provide a relative ranking of sites of suspected contamination from hazardous substances. This model will assist the Air National Guard in setting priorities for follow-on site investigations.

This rating system is used only after it has been determined that (1) potential for contamination exists (hazardous wastes present in sufficient quantity), and (2) potential for migration exists. A site can be deleted from consideration for rating on either basis.

DESCRIPTION OF MODEL

Like the other hazardous waste site ranking models, the U.S. Air Force's site rating model uses a scoring system to rank sites for priority attention. However, in developing this model, the designers incorporated some special features to meet specific DoD program needs.

The model uses data readily obtained during the Preliminary Assessment portion of the IRP. Scoring judgment and computations are easily made. In assessing the hazards at a given site, the model develops a score based on the most likely routes of contamination and the worst hazards at the site. Sites are given low scores only if there are clearly no hazards. This approach meshes well with the policy for evaluating and setting restrictions on excess DoD properties.

Site scores are developed using the appropriate ranking factors according to the method presented in the flow chart (Figure 1 of this report). The site rating form and the rating factor guideline are provided at the end of this appendix.

As with the previous model, this model considers four aspects of the hazard posed by a specific site: possible receptors of the contamination, the waste and its characteristics, the potential pathways for contaminant migration, and any efforts that were made to contain the wastes resulting from a spill.

The receptors category rating is based on four rating factors: the potential for human exposure to the site, the potential for human ingestion of contaminants should underlying aquifers be polluted, the current and anticipated uses of the surrounding area, and the potential for adverse effects upon important biological resources and fragile natural settings. The potential for human exposure is evaluated on the basis of the total population within 1,000 feet of the site, and the distance between the site the the base boundary. The potential for human ingestion of contaminants is based on the distance between the site and the nearest well, the groundwater use of the uppermost aquifer, and population served by the groundwater supply within 3 miles of the site. The uses of the surrounding area are determined by the zoning within a 1-mile radius. Determination of whether or not critical environments exist within a 1-mile radius of the site predicts the potential for adverse effects from the site upon important biological resources and fragile natural settings. Each rating factor is numerically evaluated (0-3) and increased by a multiplier. The maximum possible score is also computed. The factor score and maximum possible scores are totaled, and the receptors subscore computed as follows: receptors subscore = (100 x factor score subtotal/maximum score subtotal).

The waste characteristics category is scored in three stages. First, a point rating is assigned based on an assessment of the waste quantity and the hazard (worst case) associated with the site. The level of confidence in the information is also factored into the assessment. Next, the score is multiplied by a waste persistence factor, which acts to reduce the score if the waste is not very persistent. Finally, the score is further modified by the physical state of the waste. Liquid wastes receive the maximum score, while scores for sludges and solids are reduced.

The pathways category rating is based on evidence of contaminant migration or an evaluation of the highest potential (worst case) for contaminant migration along one of three pathways: surface-water migration, flooding, and groundwater migration. If evidence of contaminant migration exists, the category is given a subscore of 80 to 100 points. For indirect evidence, 80 points are assigned, and for direct evidence, 100 points are assigned. If no evidence is found, the highest score among the three possible routes is used. The three pathways are evaluated and the highest score among all four of the potential scores is used.

The scores for each of the three categories are added together and normalized to a maximum possible score of 100. Then the waste management practice category is scored. Scores for sites with no containment can be reduced by 5 percent. If a site is contained and well managed, its score can be reduced by 90 percent. The final site score is calculated by applying the waste management practices category factor to the sum of the scores for the other three categories.

HAZARDOUS ASSESSMENT RATING METHODOLOGY GUIDELINES

I. RECEPTORS CATEGORY

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
A. Population within 1,000 feet (includes on-base facilities)	0	1-25	26-100	Greater than 100	4
B. Distance to nearest water well	Greater than 3 miles	1 to 3 miles	3,001 feet to 1 mile	0 to 3,000 feet	10
C. Land Use/Zoning (within 1-mile radius)	Completely remote (zoning not applicable)	Agricultural	Commercial or Industrial	Residential	3
D. Distance to installation boundary	Greater than 2 miles	1 to 2 miles	1,001 feet to 1 mile	0 to 1,000 feet	6
E. Critical environments (within 1-mile radius)	Not a critical environment	Natural areas	Pristine natural areas; minor wetlands; preserved areas; presence or economically important natural resources susceptible to contamination	Major habitat of an endangered or threatened species; presence of recharge area major wetlands	10
F. Water quality/use designation of nearest surface water body	Agricultural or Industrial use	Recreation, propagation and management of fish and wildlife	Shellfish propagation and harvesting	Potable water supplies	6
G. Ground-water use of uppermost aquifer	Not used, other sources readily available	Commercial, industrial, or irrigation, very limited other water sources	Drinking water, municipal water available	Drinking water, no municipal water available; commercial, industrial, or irrigation, no other water source available	9
H. Population served by surface water supplies within 3 miles downstream of site	0	1-50	51-1,000	Greater than 1,000	6
I. Population served by aquifer supplies within 3 miles of site	0	1-50	51-1,000	Greater than 1,000	6

II. WASTE CHARACTERISTICS

A-1 Hazardous Waste Quantity

S = Small quantity (5 tons or 20 drums of liquid)
M = Moderate quantity (5 to 20 tons or 21 to 85 drums of liquid)
L = Large quantity (20 tons or 85 drums of liquid)

A-2 Confidence Level of Information

C = Confirmed confidence level (minimum criteria below)

- o Verbal reports from interviewer (at least 2) or written information from the records
- o Knowledge of types and quantities of wastes generated by shops and other areas on base

S = Suspected confidence level

- o No verbal reports or conflicting verbal reports and no written information from the records

Logic based on the knowledge of the types and quantities of hazardous wastes generated at the base, and a history of past waste disposal practices indicate that these wastes were disposed of at a site

A-3 Hazard Rating

Rating Factors	Rating Scale Levels 0	1	2	3
Toxicity	Sax's Level 0	Sax's Level 1	Sax's Level 2	Sax's Level 3
Ignitability	Flash point greater than 200° F	Flash point at 140° F to 200° F	Flash point at 80° F to 140° F	Flash point less than 80° F
Radioactivity	At or below background levels	1 to 3 times background levels	3 to 5 times background levels	Over 5 times background levels

Use the highest individual rating based on toxicity, ignitability and radioactivity and determine the hazard rating.

Hazard Rating	Points
High (H)	3
Medium (M)	2
Low (L)	1

II. WASTE CHARACTERISTICS--Continued

Waste Characteristics Matrix

Point Rating	Hazardous Waste Quantity	Confidence Level of Information	Hazard Rating
100	L	C	H
	L	C	H
80	M	C	H
70	L	S	H
60	S	C	H
	M	C	M
50	L	S	H
	L	C	L
	M	S	H
	S	C	M
40	S	S	H
	M	S	M
	M	C	L
	L	S	L
30	S	C	L
	M	S	L
	S	S	M
20	S	S	L

Notes:

For a site with more than one hazardous waste, the waste quantities may be added using the following rules:

Confidence Level

- o Confirmed confidence levels (C) can be added.
- o Suspected confidence levels (S) can be added.
- o Confirmed confidence levels cannot be added with suspected confidence levels.

Waste Hazard Rating

- o Wastes with the same hazard rating can be added.
- o Wastes with different hazard ratings can only be added in a downgrade mode, e.g., MCM + SCH = LCM if the total quantity is greater than 20 tons.

Example: Several wastes may be present at a site, each having an MCM designation (60 points). By adding the quantities of each waste, the designation may change to LCM (80 points). In this case, the correct point rating for the waste is 80.

B. Persistence Multiplier for Point Rating

Persistence Criteria	Multiply Point Rating From Part A by the Following
Metals, polycyclic compounds, and halogenated hydrocarbons	1.0
Substituted and other ring compounds	0.9
Straight chain hydrocarbons	0.8
Easily biodegradable compounds	0.4

C. Physical State Multiplier

Physical State	Multiply Point Total From Parts A and B by the Following
Liquid	1.0
Sludge	0.75
Solid	0.50

III. PATHWAYS CATEGORY

A. Evidence of Contamination

Direct evidence is obtained from laboratory analyses of hazardous contaminants present above natural background levels in surface water, ground water, or air. Evidence should confirm that the source of contamination is the site being evaluated.

Indirect evidence might be from visual observation (i.e., leachate), vegetation stress, sludge deposits, presence of taste and odors in drinking water, or reported discharges that cannot be confirmed as resulting from the site, but the site is greatly suspected of being a source of contamination.

B-1 Potential for Surface Water Contamination

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
Distance to nearest surface water (including drainage ditches and storm sewers)	Greater than 1 mile	2,001 feet to 1 mile	501 feet to 2,000 feet	0 to 500 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	6
Surface erosion	None	Slight	Moderate	Severe	8
Surface permeability	0% to 15% clay ($>10^{-2}$ cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	Greater than 50% clay ($<10^{-6}$ cm/sec)	6
Rainfall intensity based on 1-year 24-hour rainfall (Number of thunderstorms)	<1.0 inch (0-5)	1.0 to 2.0 inches (6-35)	2.1 to 3.0 inches (36-49)	>3.0 inches (>50)	8

B-2 Potential for Flooding

Rating Factors	0	1	2	3	Multiplier
Floodplain	Beyond 100-year floodplain	In 100-year floodplain	In 10-year floodplain	Floods annually	1

B-3 Potential for Ground-Water Contamination

Rating Factors	0	1	2	3	Multiplier
Depth to groundwater	Greater than 500 feet	50 to 500 feet	11 to 50 feet	0 to 10 feet	8
Net precipitation	Less than -10 inches	-10 to +5 inches	+5 to +20 inches	Greater than +20 inches	8
Soil permeability	Greater than 50% clay ($<10^{-6}$ cm/sec)	30% to 50% clay (10^{-4} to 10^{-6} cm/sec)	15% to 30% clay (10^{-2} to 10^{-4} cm/sec)	0% to 15% clay ($>10^{-2}$ cm/sec)	8
Subsurface flows	Bottom of site greater than 5 feet above high ground-water level	Bottom of site occasionally submerged	Bottom of site frequently submerged	Bottom of site located below mean ground-water level	8

B-3 Potential for Ground-Water Contamination -Continued

Rating Factors	Rating Scale Levels 0	1	2	3	Multiplier
Direct access to groundwater (through faults, fractures, faulty well casings, subsidence, fissures, etc.)	No evidence of risk	Low risk	Moderate risk	High risk	8

IV. WASTE MANAGEMENT PRACTICES CATEGORY

A. This category adjusts the total risk as determined from the receptors, pathways, and waste characteristics categories for waste management practices and engineering controls designed to reduce this risk. The total risk is determined by first averaging the receptors, pathways, and waste characteristics subscores.

B. Waste Management Practices Factor

The following multipliers are then applied to the total risk points (from A):

Waste Management Practice	Multiplier
No containment	1.0
Limited containment	0.95
Fully contained and in full compliance	0.10

Guidelines for fully contained:

Landfills:

- o Clay cap or other impermeable cover
- o Leachate collection system
- o Liners in good condition
- o Adequate monitoring wells

Surface Impoundments:

- o Liners in good condition
- o Sound dikes and adequate freeboard
- o Adequate monitoring wells

Spills:

- o Quick spill cleanup action taken
- o Contaminated soil removed
- o Soil and/or water samples confirm total cleanup of the spill

Fire Protection Training Areas:

- o Concrete surface and berms
- o Oil/water separator for pretreatment of runoff
- o Effluent from oil/water separator to treatment plant

General Note: *If data are not available or known to be complete the factor ratings under items I-A through I, III-B-1, or III 6-3, then leave blank for calculation of factor score and maximum possible score.*

APPENDIX D

PHOTOGRAPHS

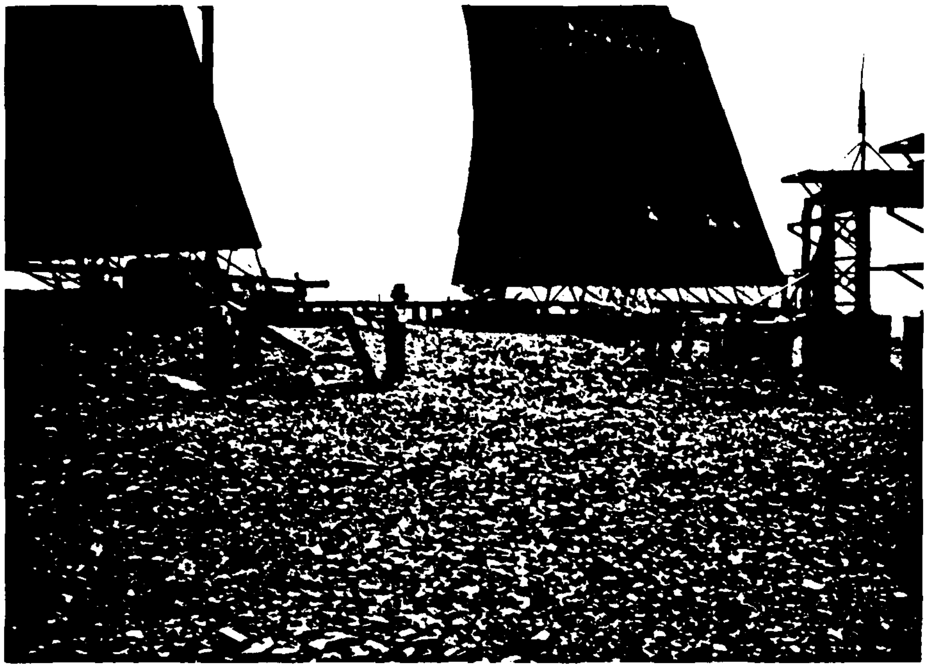

Photo 1. Big Mountain grounds (view looking west).

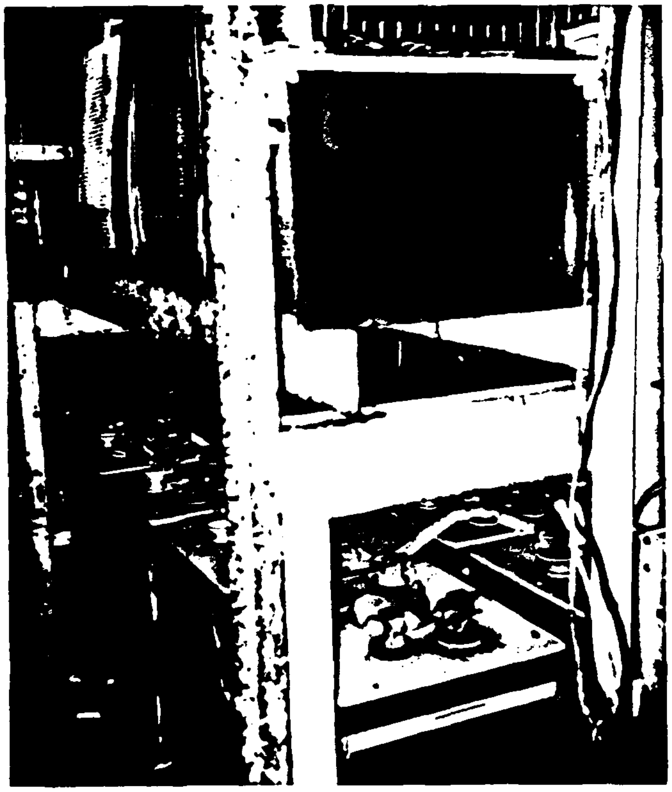

Photo 2. Lead-acid storage batteries within communications building.

Photo 3. Lead-acid batteries within communications building (background).

Photo 4. Water mixed with decomposed asbestos tiling in the engine room.

Photo 5. Water and paint cans on asbestos floor in engine room.

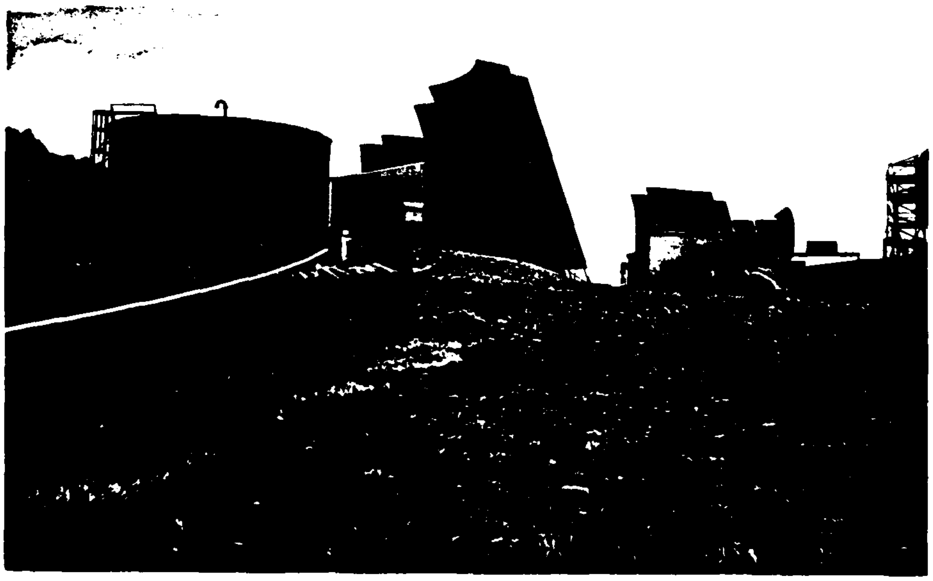

Photo 6. Antennae and buildings (view looking east).

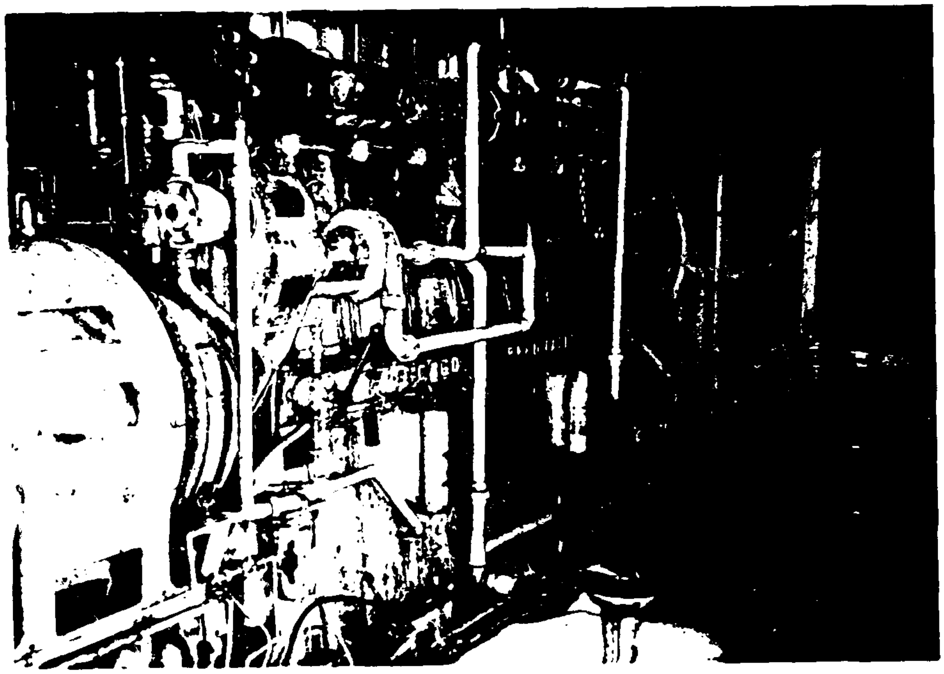

Photo 7. Generators within equipment building.

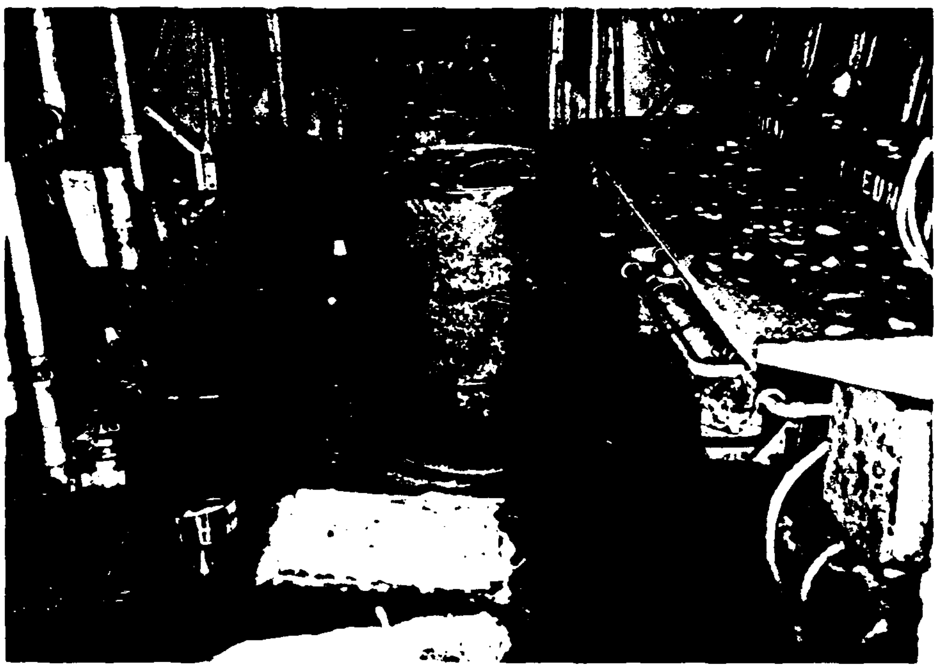

Photo 8. Generators within equipment building.

Photo 9. Generators in equipment building.

Photo 10. Old flight operations building (north side of runway).

Photo 11. Debris mound (100 yards northeast of flight operations building).